THE ELECTRICAL WORLD

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Vol. VI. NEW YORK, SEPT. 19, 1885. No. 12.

WE have to acknowledge receipt of $5 from Mr. Joseph Lattig, Maueh Chunk, Pa., being contributions to the Bartholdi Statue Pedestal Fund. The amount has been handed over to the New York *World*.

THERE is some curiosity as to the exact shape of the surplus of $4,430,393 which the Western Union Company says it will have after paying the quarterly dividend. No effort will be made officially to gratify the thirst for information on this subject.

THE Brooklyn Underground Wire Commission has handed in its first report, which contains some conclusions that have been admitted long ago. The commission, although not offering anything final as yet, deserves credit for its early preliminary report.

THE subscribers of the New England Telephone Company want to know whether the last straw has been laid on their backs yet. The company replies serenely that it does not propose to run its business as a charity to the public, but intends working for a fair dividend.

MR. EDWARD S. STOKES is the Oliver Twist of the telegraph business, and asks incessantly for "More!" He attends all the auction sales of telegraph and telephone properties, and buys them up without any hesitation. There is apparently no limit to his appetite for wires and poles.

THE American Electric Manufacturing Company has secured control of the Fuller-Wood system of electric lighting, and will proceed at once to push it with the greatest vigor. We hear also of the existence of an arrangement between two of the most important companies in the incandescent field.

COMPARATIVELY little attention seems to have been devoted to the problem of employing the telephone in connection with railway work. There is no doubt that considerable railroad business could be transacted in this way, and at a reduction in cost over the present method. Negotiations, we learn, are in progress between the London & Northwestern Railway Company, and one of the telephone companies, with the object of connecting the whole of the 2,000 stations on the system of that railway by telephone. We shall watch with interest the outcome of this English experiment, which may have an important bearing on the telephone industry of the future.

A DECISION has been given in the Iowa Supreme Court in favor of the Western Union Company on a suit for damages attributed to the negligence of the agents of the company in not copying a telegram accurately. The question involved was one of profit on a purchase of apples. The court cited the opinion of the Supreme Court of Wisconsin in a similar case, that "profits on a contract never made are quite too remote and uncertain to be taken into consideration." Plaintiff had paid no attention to the inaccurate telegram, but the price of apples advanced afterward, and on buying he had to pay a higher price. It was held, however, that he had proven no damage beyond the cost of the telegram.

WHILE our immense timber lands have made wooden telegraph poles so cheap, the time must soon arrive when their increased cost will render their use prohibitory. As yet iron poles have found little or no employment in this country, but with the increasing cheapness of iron, and its acknowledged durability for the purpose, the time is not far distant when they will find a wide application. Iron telegraph posts have been introduced with great success in Switzerland and some of the British colonies, and are now being extended daily. They have been already put up on Swiss railways a distance of 350 miles, and in Prussia they are being placed experimentally on the railway from Weissenfels to Gera, and on the line between Berlin and Potsdam. But few are in use in this country.

REFERENCE is made in another item on this page to suits recently settled in Iowa and Wisconsin in favor of the Western Union against plaintiffs who wanted damages for the loss of possible profits that depended on the delivery of telegrams promptly and accurately. A third case of the kind is now reported from the Kentucky Court of Appeals, in a case where stock was sold at a sacrifice. The broker in New York bought for his Southern customer and telegraphed to him. The telegram was not delivered, and the stock went down. Suit was brought by the customer on the ground that, had the telegram been delivered, he could have remitted sufficient "margin" to cover the fall in price. The Court held that the loss was too remote and too uncertain a consequence of the company's negligence.

AT a recent fire in England the delay in summoning the fire department was caused by the firm alarm being out of order. This suggests the expedience of periodically inspecting and testing all fire alarm apparatus, which we believe is done in all well regulated fire departments. It suggests, in addition, the wisdom of a similar testing of all automatic fire alarms, such as thermostats and similar devices. Many of these, as constructed, are materially liable to deterioration after the lapse of time, and hence may be found wanting in the hour of need. Even the best apparatus should be periodically inspected, and it is folly to depend blindly upon any automatic device that is never looked at. When intelligently employed, however, these devices are of very great value, as has often been demonstrated.

ELECTRICITY as applied in medicine has already attained such prominence that in more than one medical institution special chairs are provided for its study. In this issue we give our readers the description of a machine which, by the aid of electricity, may be the means of greatly improving the sanitary condition of our cities. This convenient method of producing ozone places a valuable hygienic agent at the disposal of physicians, and they have not been slow to recognize the fact. This additional application of the static machine recalls its employment for the condensation of lead fumes, recently chronicled by us, and strengthens us in the opinion that the field for the static machine is by no means as circumscribed as has heretofore been generally assumed. At the present rate of progress we may even imagine in the near future as many competing static machine manufacturers as there now are dynamo-makers, and each with a separate claim of superiority.

ADVOCATES of a subterranean wire system will meet with more vexatious opposition or disappointment from your average "statesman" than from any live telegraph company. This is well illustrated by the letter of our Philadelphia correspondent to-day, in which it is shown that six years ago an ordinance was passed ordering all wires to be placed underground by January, 1885. This order seems to have been extended one year, until January 1, 1886, yet at this very day, only three months before the expiration of the notice, the Western Union is still knocking unanswered at the door of the Philadelphia Councils, begging for permission to dig up the streets. That company's last petition for permission to open the streets was dated June 11, yet no action has been taken upon it thus far, and, although that company has already purchased considerable material for underground purposes, it cannot lift a single one of the Quaker city's abominable cobblestones. This is tantamount to passing a law that a man shall swim a river and then tying him hand and foot, sewing him up in a sack and pitching him in. All this goes to prove that most of the aërial lines will stay longer than some people expect.

THE fact that carrier-pigeons are employed, as late as September, 1885, for telegraphic purposes will inspire some of our old-timers with reminiscences of what may be called the halcyon days of the telegrapher. The latest occasion was the attempt last week of the Puritan and Genesta to race forty miles on the sea, and, as there could not be any practical telegraphic communication, some of the enterprising newspaper correspondents took with them a cote of carrier-pigeons, which were intended to fly back with the record as the white-winged contestants skimmed over the billows. A comparison of the past with the present day will show that the message by pigeon is just as liable to go astray as is the message by telegraph, while the latter is inconceivably faster. Some of the trained birds which were thrown up at sea last week got lost, and in one case an exhausted pigeon, with its message under its wing, was picked up at New Haven, Conn., 200 miles from its destination and 24 hours after the gist of the message in question was known by telegraph in San Francisco, London, Paris and more remote points. Yet it behooves us not to lose sight of this primitive mode of inter-communication, for in case of invasion or civil war a beleaguered city can certainly have no electrical telegraphic communication with the outside world.

A CENTURY ago, when there was no electric telegraph and all the world stood breathless awaiting the latest news by "telegraph"—the semaphore lines—no one considered the huge poles, with their single and double arms vibrating methodically, as the electric armature vibrates now, to be "unsightly." The news received was only too welcome, and every one knew that a proposition to put the semaphores underground—as unsightly as they were—would, if carried out, cut that particular community off from the world at large. And when the "pony-rider" came clattering down the country lane at breakneck speed no one objected, for he also was only too welcome. All the village crowded around him as he leaped from his saddle to mount a fresh horse, and all clamored for their "mail." It was the kind word from a distant child, or wife, or husband, or the latest bulletin from the seat of war, and everybody made way for and welcomed the fast mail. The electric telegraph is the pony-rider, the semaphore and steam engine combined—the quintessence of all—yet it is taxed and hampered and ordered underground, when the work is not practicable until the weaker companies fall by the wayside. It would be better, we think, for telegraph companies to withdraw from cities that make unreasonable demands, and let the inhabitants of those benighted places go back to the pony-express, the semaphore, the bon-fire on hills at night and the U. S. mail.

IN a letter to the London *Times*, Professor Richard A. Proctor, the well-known astronomer and lecturer, states that out of fifteen trans-Atlantic telegrams which he had had occasion to send or have sent to him in six years, three miscarried. This, he rightly argues, is too great a proportion of failures, and he consequently warns the public as to what they have to expect from the cables as now conducted. In answer to this letter, another correspondent of the *Times* seeks to exonerate the cable companies from all blame, and lays it at the door of our American telegraph lines. He bases his assertions upon his experience in this country last year, when, having had occasion to dispatch a large number of inland messages from a great many different places, both in the United States and Canada, he was astonished at the number of errors that occurred. On several occasions either the message never reached its destination or he was himself in time to receive it. In cases when he saw the message after its delivery, he found it the exception, rather than the rule, for it to have been transmitted absolutely without error. It would seem to be unjust to throw the whole responsibility in this matter on our telegraph lines, as errors are quite as liable to occur in cable transmission as on land lines. The fact remains, however, that more delays and mistakes occur on our telegraph lines than would seem to be warranted. What the causes of these failures are the companies themselves will know best, and a little attention given to the matter may do much toward mitigating the evil. We would suggest the employment of good operators at fair salaries as a cure for the evil.

The Village Telephone System.

At the Telephone Convention, held last week, the village telephone installation exhibited by the Western Electric and American Bell companies attracted considerable attention. It is apparent that many villages and small towns are denied the benefits of telephonic communication on account of the expense involved in the equipment and maintenance of a telephone exchange; and it was for the purpose of overcoming the drawback that the "Village System," as it is called, was devised by Mr. Gilliland.

In this system a number of lines are run over the whole circuit and enter every subscriber's station. A certain number of subscribers' instruments, say six in number, are in circuit with line No. 1, and a second set of six subscribers in circuit with line No. 2, and so on. One of the lines entering the subscriber's station is thus in connection with his instrument. The remaining ones, however, are merely looped in. A switch is provided which has a number of knobs, and by pressing either of the latter the subscriber can put himself in circuit with any of the other lines. In this way he is enabled to signal any of the other subscribers and to converse. There being six subscribers to a line, it is evident that an individual call is required. The entire apparatus, including the special switch, is mounted on a single board, and the construction is such that no neglect of the subscriber can interfere with the proper working of the system. Thus no two knobs of the switch can be pressed in at one time, the pressure upon one of them throwing all the others out. The replacing of the telephone upon the hook cuts out everything with the exception of the call-bell.

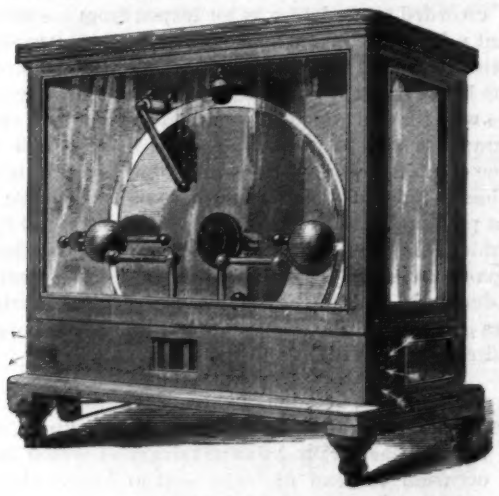
This system is in operation at Leicester, Mass., where 12 subscribers now communicate with each other in this manner. It is evident that the system is not contemplated for a very large number of subscribers, as then the number of lines required would be prohibitory. But it is calculated that even with eight lines and fifty subscribers (about six to a wire) this system can compete with the exchange system.

The Ozone Machine.

The allotropic form of oxygen, known as ozone, has for many years been the subject of investigation and study by many eminent men of science, and the results of these labors have given ozone a very prominent place in the economy of nature. Not only has ozone been found to have hygienic properties of a very high order, but many experiments show that it is destined to have a wide field in the industrial arts.

Ozone may be produced in a variety of ways. Thus it is formed during the electrolysis of water; during the slow combustion of phosphorus in *moist* air; during the slow combustion of alcohol, ether and volatile oils; by decomposing potassic permanganate with sulphuric acid, and by several other similar reactions.

The most convenient method of producing ozone, however, consists in passing electric discharges through air or



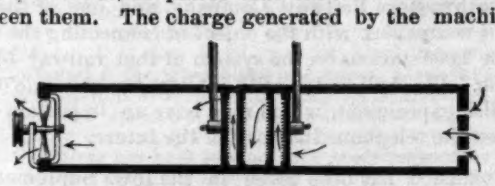
OZONE MACHINE.—FIG. 1.

oxygen. It is this action which causes the formation, during thunderstorms, of large quantities of ozone, the presence of which is manifested by a peculiar sulphurous odor, and by its frequently observed action upon milk, which is turned sour by it.

Ozone being a powerful oxidizing agent, its action upon decaying and putrescent organic matter is such as to rapidly convert these dangerous accompaniments of dense populations into innocuous bodies. In doing so, however, the power of ozone is spent, and thus it happens that the quantity of ozone present in the atmosphere of cities is very small as compared with that in the open country. The literature on ozone contains many examples of its beneficial effects in checking violent epidemics, and it has often been placed on record that the mortality in cholera epidemics was at its greatest when ozone was absent from the atmosphere. It has also been shown that on more than one occasion its reappearance, caused by a thunderstorm, put a stop to the epidemic. As a disinfectant, therefore, its value is undisputed, but until recently there was no convenient method of producing ozone so that it could be universally applied. The methods first indicated above, being essentially chemical processes, require constant renewal of material, with its attending expense, and the formation of ozone takes place but slowly.

The employment of electricity, however, furnishes us with a convenient method of producing ozone mechanically in large quantities and at greatly reduced cost. The demand for a convenient ozone generator for the use of hospitals and sick rooms has led to the construction of the apparatus shown in the accompanying engravings, and of which Mr. Henry D. Hall, of this city, is the inventor.

The apparatus seen in the cuts is a self-exciting static machine tightly inclosed in a glass case, and the supporting case of which contains an air passage. One end of this passage contains openings for the entrance of air, Fig. 1, and at the other is a small exhaust ventilator, Fig. 2, which causes a constant circulation of air through the air passage. Midway in the latter there is situated a series of brushes, so placed that the air is forced to pass between them. The charge generated by the machine is



OZONE MACHINE.—FIG. 3.

led to these brushes, Fig. 3, and a constant discharge takes place between them. In this way the air is rapidly ozonized.

The ventilator is driven from the same shaft to which the glass discs are fixed, and thus the turning of but a single crank generates the electricity, and at the same time causes a constant stream of air to pass through the ozonizer. It is obvious that the machine can be kept in constant operation by employing an electric, water or other motor.

A number of these machines have been placed in banks, exchanges and hospitals in this city, and several private residences have been furnished with them, in all cases with marked improvement in the condition of the atmosphere of those places. Indeed, it has even been suggested that an ozone sanitarium be established, where persons suffering from the effects of breathing impure air might come and breathe freshly ozonized air for a few hours each day.

As stated above, ozone will probably soon occupy a prominent place in the industrial arts. Being perhaps the most active oxidizing agent known, it ranks as a highly powerful bleaching agent. It bleaches indigo, corrodes cork, india rubber and other organic bodies, and even oxidizes silver. Experiments have shown that it can be advantageously employed for bleaching linens and oils (such as linseed), while sugars can also be given a lighter color by subjecting them to treatment with ozone. There are numerous other processes in which the machine can be employed, but those indicated will alone comprise a wide domain, when fully developed. The apparatus we have just described has lately been introduced by the Ozone Machine Company, of this city, and several machines which we saw in operation worked with the greatest smoothness, giving a practically unlimited supply of ozonized air.

Improvements in Conductors.

BY JAMES RODGERS.

The matter of improvement in the means for conducting electricity overland seems to attract but little attention at the present. Whether this is owing to a belief that nothing can be gotten at better than, or as cheap as, the regulation iron wire, or that the inventors of the country have not had their attention called to this particular line of invention, can best be answered by looking at what has been done, when we must conclude that it is in part both

It may be that there is some reason for the former conclusion, and we hope the second conclusion is true, for we think that if some activity were shown by inventors and electricians, great strides could be made in this line.

Several attempts have been made in this country and in Europe to produce something better than the ordinary iron wire, and some of the attempts have been comparatively recent. But is not the subject of enough importance to warrant all the experiments thus far made and many more? Cannot a wire be produced which will have nearly all the advantages of copper wire as an electrical conductor and sufficient of the tensile strength of iron wire? It would seem that while no doubt much money has been spent in experimenting in this line, the advantages to be gained by a successful inventor in this branch of the science would be ample reward to lead to extensive experiments.

It is well known that copper is one of the best conductors of electricity, and it is as well known that iron possesses great tensile strength; and so possessing these qualities, these two metals have been used in all efforts made to produce a conductor in the form of wire better than the common iron wire, and yet retaining its tensile strength.

We have had an iron wire with a coating of copper, which coating added but little to its conductivity, and as the process of coating was by electrolysis, the copper scaled off after a short time, and thus exposed the iron to the action of the elements, when by the aid of the copper a chemical action was produced which soon destroyed the wire. Next in order was introduced a copper wire with a shell of iron, which shell was not joined so as to make it perfectly tight, and so this, like the other, was subject to early destruction from the action of the elements.

Solid wires of various composition were in time brought forward, but they met with no success. It has been urged that the only practicable way to use iron or steel and copper as one wire, is to place the copper inside of the iron or steel in such a way that it will be perfectly free and safe from contact with the weather, or, in other words, to weld the iron or steel around the copper, and in this form it is believed by those who have studied the subject, a conductor of electricity will be found which will very nearly equal copper wire as a conductor, and possess sufficient tensile strength to answer the purposes of iron wire.

Having determined what form these two metals should take to render the best service, the question is narrowed to one of mechanical apparatus to produce the wire in the shape described. The only effort known to the writer thus far made to produce such a wire was by taking a billet of copper and pouring around it, in a mold, molten steel, and when the ingot thus formed had cooled sufficiently to allow it to be taken from the mold, it was re-heated and then rolled; but as the copper heated much quicker than the steel, it ran out from between the steel when it was forced into the rolls, and thus this process, so far as the writer knows, failed.

The purpose of this article is to bring to the attention of electricians and inventors the state of the art at the present time, that they may see how wide and open is the field for improvement. It is hardly necessary to state that a wire having almost the electrical conductivity possessed by copper wire and the tensile strength of iron wire, and free from the defects found in the compound wires thus far produced, would be a most valuable product. In conversation with electricians throughout the country, the writer has learned that if such a wire could be produced at a cost nearly as low as iron wire, it would at once take the place of all iron wire now in use and to be hereafter used, by the telegraph companies of the country, using, as they do, many thousands of tons annually.

Are not the possibilities of success and the rewards to follow sufficient to warrant inventors in giving much thought to the subject? We have ourselves given considerable study to the matter, and would be pleased to see the subject discussed further through the columns of this journal.

Ahead of Time.

A writer to the New York *Tribune* relates the following: "On a certain Tuesday morning a telegram was received, per night message, by the New York house from a San Francisco correspondent, asking the price of an article sold by the New York firm. The New York house cabled at 10 A. M. to London for the price, and the same was received in London about 3 P. M. the same day, five hours later than New York. The London house wired to

OZONE MACHINE.—FIG. 2.

Worcestershire for the price from a manufacturer, and received the same per wire at 5 P. M. the same day, Tuesday. London than cabled the price to New York at 5 P. M., and the dispatch was received in New York about 12 noon the same day, Tuesday, or five hours earlier than London. New York then wired to the San Francisco correspondent (five hours earlier than New York), who received it when he came down to business on the morning of the same day, Tuesday. San Francisco wired to New York accepting the price, which dispatch was received in New York at 3 P. M. the same day, Tuesday, five hours later than San Francisco. Now note the results:

	Miles.
San Francisco to New York (inquiry)	3,000
New York to London (for price)	3,000
London to New York (giving price)	3,000
New York to San Francisco (giving price)	3,000
San Francisco to New York (accepting price)	3,000
In all	15,000

Not counting the dispatches which passed between London and Worcestershire. And yet at the hour of 3 P. M, Tuesday, when New York received the dispatch from San Francisco accepting terms, London was wiring Worcestershire for the said terms. New York stood between the 10 hours between San Francisco and London, and hence the surprising results."

The Louisville (Ky.) Telephone Exchange.

We are able this week to place before our readers an illustrated and very complete description of the new Louisville (Ky.) Telephone Exchange system, concerning which telephone people have manifested so much interest. This telephone exchange is well worthy the personal inspection of every progressive telephone manager, and in its equipment is the finest ever inspected by the writer. It is the latest expression of all that has been done in the direction of the ideal telephone exchange, and we very much doubt if any one will question its right to the claim of being the finest exchange in the United States to-day.

The Louisville Telephone Exchange was started in 1879, at No. 63 Third street. After the discarding of two of the earlier styles of switchboard, the Gilliland board was adopted, and the exchange was removed to the Board of Trade building. It remained in that place until its increased patronage and prospects for a still larger business compelled the company to select a new location, where new and permanent buildings, adequate for all the future demands of the business, could be erected. The present site was therefore selected, and work on the new plant begun in the early part of August, 1884. The new buildings were completed in June, 1885, and then began the work of transferring the lines from the old exchange to the new. This was accomplished gradually, trunk lines being maintained between the two exchanges during the transfer, and the wires being worked from the new exchange as fast as they were transferred. The whole work was successfully completed on the 15th of August last.

The site of the new exchange is a lot 44 by 210 feet, between Fourth and Fifth streets, and running through from Jefferson to Green street, the principal front being on Jefferson street. The lot, as well as the two buildings just erected upon it, are owned by Messrs. J. B. Speed and James Clark, the President and Vice-President of the company, and the site was selected and the buildings were erected specially as a permanent location for the exchange.

Both buildings are constructed in a most thorough and substantial manner, their entire walls being laid in cement. The front of the main building is built of pressed brick, tastefully ornamented with terra cotta and Mt. Sterling-stone. Our engraving, Fig. 1, shows the front of the building, which is 44 by 85 feet, and three stories high. The offices of the Ohio Valley Telephone Company are on the second floor. In front and to the right as you go up the broad and handsome stairway is the office of General Manager H. N. Gifford, and to the left are the general offices of the clerical department. The offices all front on the street, and are very handsomely fitted up. They are, moreover, very pleasant, and well adapted to the purposes for which they are intended. The remainder of the front building is rented out.

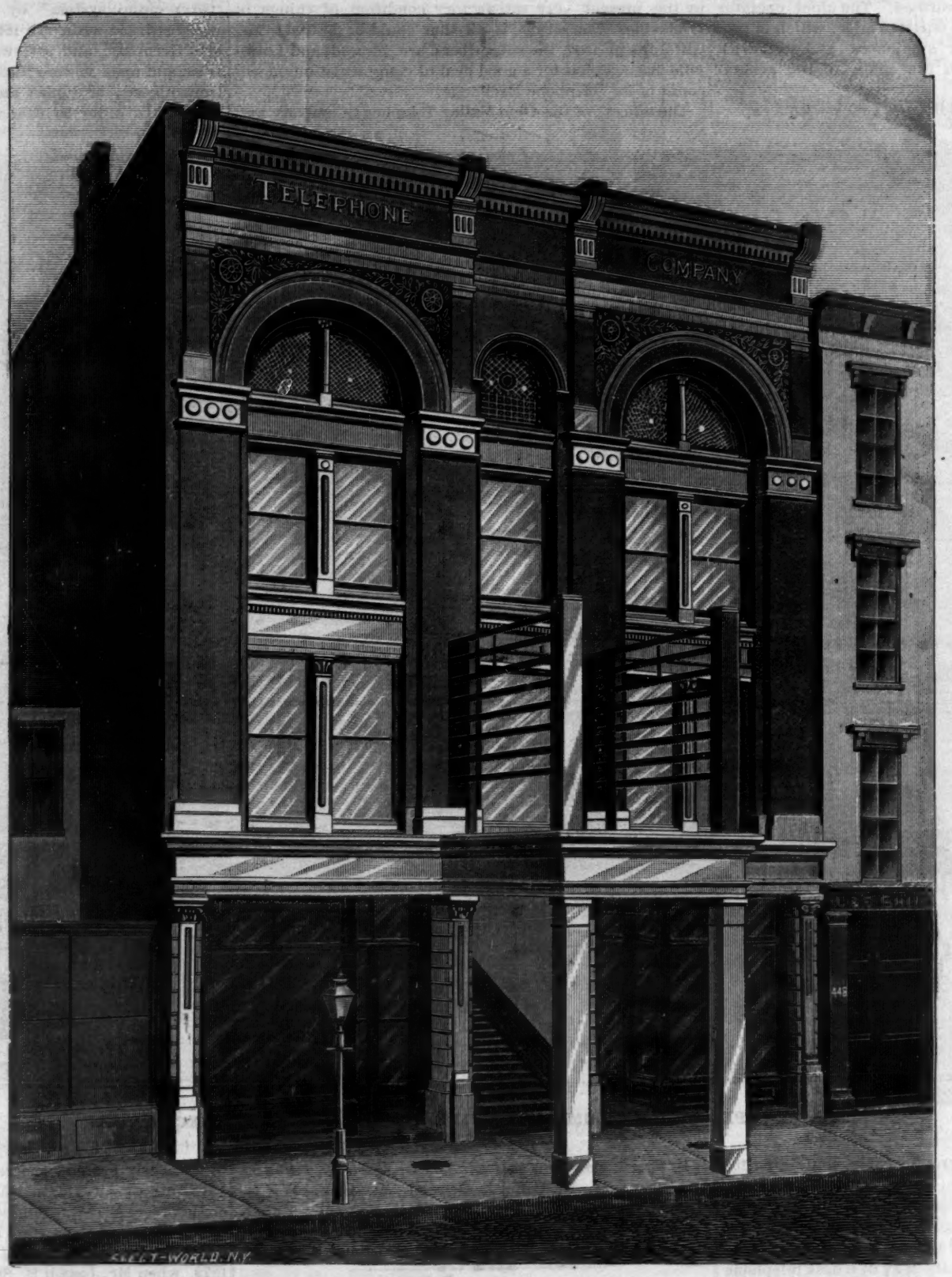


FIG. 1.—THE LOUISVILLE, KY., TELEPHONE EXCHANGE BUILDING AND OFFICES OF THE OHIO VALLEY TELEPHONE COMPANY.

At the front of this building, and on a level with the second floor, is one of the wire racks, as shown in the illustration, Fig. 1. This rack has a capacity for receiving eight hundred lines, which are connected to a series of lightning arresters by Callender "bitite" insulated wire, and from thence are connected to the terminals in what is called the shifting room by Patterson anti-induction cables. These cables, as well as several others which connect with different pole routes, are concealed in a neatly constructed trough which runs the entire length of the front building through to the rear one, in which the operating room is located.

The exchange proper is in the rear building. This latter is 44 by 66 feet, and is entirely given up to exchange purposes. It was built as an absolutely fire-proof structure. The walls are ten inches thick, double, and with air spaces between them. The roof is made up of, first, a wrought iron frame, then a porous tiling about four inches thick, next a layer of cement, and lastly a slate covering. A winding iron stairway traverses this building from basement to attic, and every precaution has been taken to avoid the possibility of fire.

The first floor of the rear building is given up to an inspector's room, in which are two power generators run by separate water motors, each connected with the street water main by special service pipes; a store room, in which are kept instruments, batteries, bells, etc.; the battery room, where, besides the batteries used in connection with the exchange transmitters, may be seen a pole-changer, fully equipped with local and main cells ready for instant use when needed; the dinner room for the line men, in which is a lead sink for cleaning batteries; and another store room for line material, such as wire, insulators, etc. The steam heating apparatus is also located here, and it may be mentioned that both buildings are to be heated throughout by steam.

On the second floor is found the chief operator's office, which is neatly furnished and worthy of special attention. In it is the switching arrangement, by which the several appliances for calling subscribers are controlled. It consists of a metallic bar, about two feet long, to which are attached several switches, by means of which either of the power generators, or the pole-changer, and also the calling bar of each section of the switchboards, may be switched on or off at pleasure.

One of the neatest arrangements in the whole system is the shifting room on the third floor. This room is 16 by 16 feet, and absolutely fire-proof. The cables from the different routes all come into this room through neat walnut cases in regular order, and are arranged on terminals of one hundred wires each on one side of the room. At right angles with this is another set of terminals, to which are attached the cables running to the switchboards. Above these tables is a rack provided with openings to correspond with the terminals. This affords facilities for running office wire through the different openings from the terminal of any line to that of any section of the switch-boards in such a manner as to avoid entirely the snarl of wires usually found in a tower or shifting-room. The advantage of having the whole arrangement stand clear of everything and entirely open, so as to be accessible from all sides, and at the same time free from destruction by fire, mice, etc, is apparent.

At both ends of all the Patterson cables in the shifting room, the central induction wire is turned back and soldered to the lead covering, and then attached to large special ground wires. All the cables running from the shifting room to the switch boards, as well as those connecting the switchboards, are of the Western Electric "lead tape" type, and the same precaution is taken in grounding them also. As a result of Mr. Gifford's precaution in this respect, he has very little trouble from induction or cross-talk.

The operating room, 35 by 50 feet, is on the second floor. It is situated in the middle of the square, is free from dust and all outside noises, and splendidly adapted to the purpose to which it is put. This room contains seven switchboards, one of them being an extra-territorial board. They are all of the Western Electric multiple pattern. This is one of the neatest exchange rooms it would be possible to find. The switchboards are all arranged across the east side of the room, as shown in the engraving, Fig. 2. There is not a wire to be seen, the boards being cased up in such a way as to conceal all wires and render it impossible for them to be affected by dust or mice. The transmitters even are out of sight, being inside the casing and suspended on rubber straps so as to prevent their being affected by any jar which the casing may receive. The switchboard transmitters are talked into through nickel tubes, which can be adjusted so as to conform to the height of the operator.

The extra-territorial cable occupies the position of A, or No. 1, in the main operating room. It has a full equipment of springjacks the same as the other tables. The lines on this table terminate in the cords. As it is also provided with a set of annunciators by which city calls for country points can be almost instantaneously transferred to it, the operator is enabled to make a connection on this board nearly, if not quite, as rapidly as they can be made between two city subscribers.

The multiple boards are provided with 200 annunciators and 1,400 springjacks each, 200 of the 1,400 springjacks being used as answering jacks for the table upon which they are placed. These answering jacks are found directly below the annunciators and above the lower key shelf. Upon this lower key shelf are placed the listening and calling keys and connecting cords. An upper key-shelf above the annunciators carries the connecting cords for use with the 1,200 springjacks upon the board.

The operators handle the two hundred subscribers whose lines terminate on each of the boards, but provision is made for a third operator, should her services be required in case of a rush. The operators are provided with the new Gilliland head telephone. This telephone, as con-

structed, is extremely light, but very loud. It consists of a cast-iron case, cup-shaped, the cup being magnetized and forming the permanent magnet of the telephone. An electro-magnet is attached by its heel to the centre of the cast-iron cup, its free end forming the pole to which is opposed the diaphragm. The diaphragm is held in place by the ear-piece of the telephone. The instruments weigh but four ounces, and the operators are well contented to wear them, preferring them in fact to hand telephones.

In the old exchange, Gilliland switchboards were used, and an operator was able to take care of only fifty lines. In the new exchange, with the multiple boards, each operator is able to take care of one hundred lines, the number of operators being thus reduced practically one half.

A feature of this exchange is a trouble clerk, besides the chief operator, and the exclusive duty of the clerk is to receive and keep a record of all line and instrument troubles, and, under the direction of the electrician, see that they are given to the repairmen. The chief operator and trouble clerk have each a separate table, which is provided with the latest monitor appliances, and also with special lines connecting with the offices of the general manager and inspector.

At the back of this rear building is a rack with a capacity of 1,200 lines. An underground cable, containing 100 wires, also comes in here. All of these wires reach the shifting room, of course, in the same way as those from the front. The capacity of the exchange is 4,000 subscribers, and about 1,400 are now connected up.

A very neat arrangement in the way of a desk telephone is to be seen on the general manager's desk. The transmitter is concealed beneath the desk, and communication is had to it through a nickel tube, which also serves the part, to a certain extent, of a resonator. By a series of switches communication is had through this telephone by the general manager with his residence, the exchange proper, the extra-territorial table, the chief operator's desk, the trouble clerk's desk and the inspector's office. A feature of this arrangement is that by the employment of a series of signals all drops are dispensed with. Nothing except the receiver, tube and switches appears above the desk.

Mr. Gifford is using hard-drawn copper wire almost exclusively for outside overhead purposes. For his city lines he uses No. 16, and for country lines No. 12. He is well satisfied with the results he has obtained, and it is his intention to eventually replace all outside iron wires with hard drawn copper. All the poles used are red cedar.

Mr. Gifford keeps a record of battery inspection, which he finds results in a great saving of sal ammoniac, and which acts besides as a check upon the battery men. A printed card, with appropriate blanks, is placed in the battery box of each telephone. A registry is made on this card, telling when it is put in the box, the location of the telephone, the kind of battery, and when set up. Afterward, when any repairs are made on the battery, the date of the repairs made is set down on the card, with the nature of the repairs and the name of the inspector. At each visit of the repair man the record is inspected, and the nature of the last repairs becomes apparent at a glance.

Mr. Gifford has worked hard and earnestly to put Louisville in the front rank as regards telephone service, and the system as it is to-day is entirely the result of his labors. Besides conceiving and putting in practice many original methods, he has not been slow to adopt the latest apparatus as approved by other exchanges. He has been seconded in all his plans by a very efficient corps of subordinates, who have been educated up to their work under his personal supervision, to which fact is probably due their present proficiency. The result of all this is shown by the present very satisfactory condition of things in Louisville. The service is all that could be desired. Mr. Gifford is pleased, the subscribers are pleased, and Louisville has occasion for a good deal of congratulation on account of its Telephone Exchange.

The officers of the Ohio Valley Telephone Company are: J. B. Speed, President; James Clark, Vice-President and Treasurer; H. N. Gifford, General Manager; W. H. Mundy, Secretary. Electrician, G. S. Maxwell; Superintendent of Construction, John Harp; Chief Operator, Mrs. Mary F. Moore; Trouble Clerk, Miss Alice Carter.

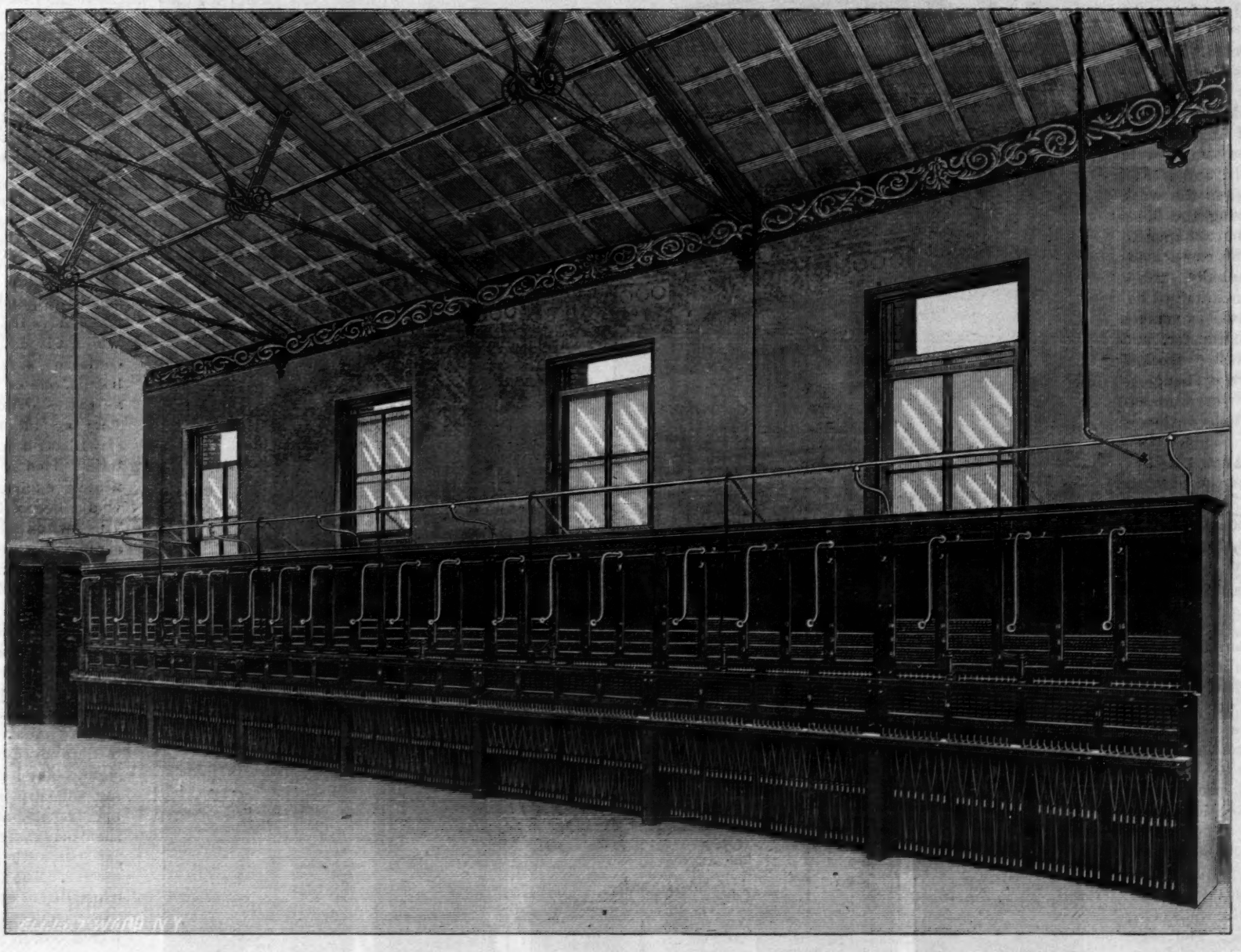


FIG. 2.—OPERATING ROOM, LOUISVILE, KY., TELEPHONE EXCHANGE.

Fighting for the Stearns Duplex.

Quite a formidable array of lawyers and electricians confronted Judge Wallace in the United States Circuit Court on Sept. 2, when argument was opened in the injunction suit brought by the Western Union Telegraph Company to restrain the Baltimore & Ohio Telegraph Company from the further use of the duplex system of telegraphy, which is claimed to be the exclusive property of the Western Union under the original patent of Joseph B. Stearns, and its subsequent re-issues direct to the Western Union Company.

The court-room was transformed into a temporary operating room, and during the course of the proceedings the learned judge descended from the bench on several occasions to inspect the mechanical appliances in connection with the explanations of experts and the arguments of counsel. In the legal conduct of the case the Western Union Telegraph Company was represented by Edward N. Dickerson, Gen. Samuel A. Duncan and C. L. Buckingham, and the Baltimore & Ohio Telegraph Company by Edward R. Bacon, Grosvenor P. Lowery, Frederick H. Betts, Rockwell Kent and J. E. Hindon Hyde.

A formal demurrer on the part of the Baltimore & Ohio Company was denied by the court; voluminous documentary evidence on both sides was then submitted and argument commenced. The day was chiefly devoted to elaborate explanations, by the aid of the wires and instruments which had been taken into court, of the nature and operation of the duplex system of telegraphy, to the use of which the Western Union claims exclusive right. The evidence went to show that when the telegraph system of Professor Morse was first put in operation between Baltimore and Washington, in 1844, two lines of wire were used, one for transmitting from Baltimore to Washington and the other for transmitting from Washington to Baltimore. Each line wire or circuit was independent, and was provided with a battery and key at its sending end and an electro-magnet and armature, which constituted the essential parts of the receiving instrument, at its receiving end. In 1845, Ezra Cornell invented the "open circuit system" by which one of these line wires was dispensed with. In 1848, the system was introduced into Germany, and afterward into other European countries, and upon it were based the improvements in double transmission, or duplex and quadruplex telegraphy, now in use. In order to overcome the obvious imperfections of the early system, successful inventions were made by Dr. Gintl, of Austria, in 1853, and by Professor Frischen, of Hanover, in 1854. Subsequent improvements were also made, but all of them were based upon the same general principle as those of Gintl and Frischen, until the year 1872, when Mr. Joseph B. Stearns, of Boston, patented a new and very valuable invention to prevent the effect upon the relay at the sending station of the return current due to the static induction of the line, and which consisted in connecting a condenser with any transmitting apparatus. This patent was acquired by the Western Union Company in January, 1873, and in February of the same year was reissued to that company. Nine years afterward, namely, in February, 1882, the company secured another reissue of what they claimed to be the same patent, but in three divisions, making nine separate claims.

Counsel for the Western Union Company presented affidavits of Louis N. Kirschbaum, formerly an operator in the Baltimore & Ohio office; Moses G. Farmer, Henry C. Townsend, who was assistant examiner in the Patent Office in 1872; Dr. Norvin Green, President, and Gen. T. T. Eckert, General Manager of the Western Union; Alfred S. Brown, General Superintendent of the Mutual Union Telegraph Company; Gerritt Smith, Fred. O. Nourse and other employés of the Western Union Company, all in support of that company's claim to the effect, in brief, that the Stearns invention is the only successful duplex apparatus

now in use, that the right of the Western Union to its exclusive use has never been disputed or infringed upon by any other telegraph company save the Baltimore & Ohio, and that the reissue of the patent of 1882 contained no new or vital principle not included in the original invention as patented 1872. Dr. Green complains that the appropriation of this duplex system by the Baltimore & Ohio has enabled that company to give the public lower rates on messages, and that this operates to reduce the profits of the Western Union. Accordingly appeal is made to the court for an order compelling the Baltimore & Ohio to discontinue the use of the duplex apparatus on all its lines, wherever employed, throughout the country.

An elaborate answer to this plea has been put in by the Baltimore & Ohio Company, supported by sworn statements of D. H Bates, President and General Manager of that company; Frank L. Pope, Frank L. Freeman, of Washington: Charles R. Cross, Professor of Mechanical Engineering in the Massachusetts Institute of Technology; Charles F. Chandler, lecturer on electricity and Professor of Chemistry in the New York School of Mines, College of Physicians and College of Pharmacy; Arthur W. Wright, Professor of Physics in Yale College; Henry B. Renwick, Civil and Mechanical Engineer; Charles Cuttriss, chief electrician of the Commercial Cable Company; John Rapieff, formerly electrician for the Russian Government; Joseph W. Larish, Manager of the Baltimore & Ohio Company's system; William Maver, Jr., electrician of that company, together with other testimony, all intended to show that there is no substantial foundation for the exclusive claim set up by the Western Union Company.

In his sworn statement, Mr. Bates makes a general answer to all the allegations in the several affidavits comprised in the plaintiff's case, and gives specific explanations and denials to many of them based on his long connection and experience with telegraph companies and his personal knowledge of the history and practical operation of the duplex apparatus. It is held on behalf of the Baltimore & Ohio Company that the reissue of the patent in 1882 was invalid in that it was not a reissue of an original patent, but the issuance of three new and separate patents, covering nine claims, and including other inventions known to the art of telegraphy within the ten years intervening since the original patent was granted

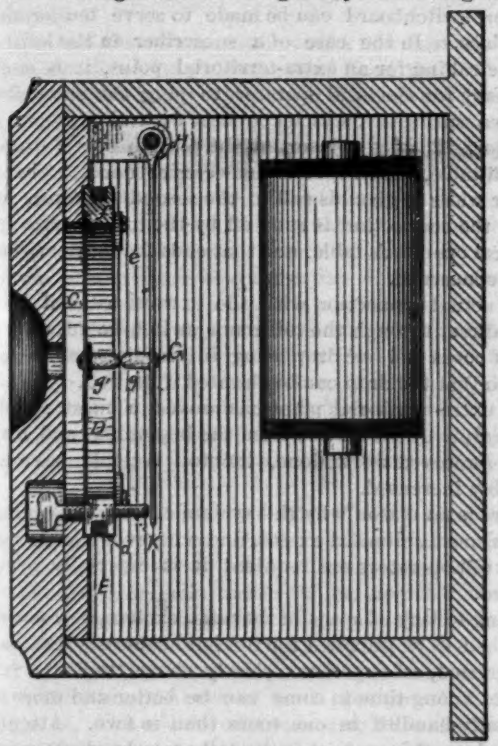


FIG. 1.—TELEPHONE TRANSMITTER, TRANSVERSE SECTION.

for one and only one invention. This broadened the claim so much as to make the last reissue under the established rules utterly invalid. In addition to this legal point, the Baltimore & Ohio Company's expert testimony asserts that the use of the condenser as limited to one station was anticipated by Profesor Varley, of England, who employed the same thing precisely to submarine telegraphy

Much reliance is placed by the Baltimore & Ohio Company on the testimony of Professor Freeman, who was Chief Examiner of the Patent Office at Washington when application was made for the last reissue of the original patent, which was granted just prior to the decision of the Supreme Court of the United States, in the case of Miller *vs.* the Bridgeport Brass Company, wherein the Court held conclusively that a reissued patent which was broader than the original was invalid. When Stearns made his original application in 1872, he claimed the use of a condenser at one station only, but before the patent issued he canceled that claim and substituted the words "at each station." When the Western Union Company obtained the reissued patent in 1882—ten years later—they left out these words, and thus, it is alleged, opened a door to the free use of the invention, as Varley's combination of 1859, above referred to, is precisely what is now used by the Baltimore & Ohio Company. The case is still on, and the further arguments of counsel will occupy several days, while a decision may not be handed down for some time to come.

A New Telephone Transmitter and Relay.

In view of the continued search after a telephonic relay, a recent patent issued to Thomas J. Perrin, of Brooklyn, N. Y., is of considerable interest, as it presents several novel features.

The instrument is a combined transmitter and relay, and is shown in the accompanying illustrations, Fig. 1 being a transverse section, Fig. 2 a rear view of the diaphragm and electrode supports, and Fig. 3 a diagram illustrating the connection and running of the circuits.

A bar of magnetic metal *D*, preferably a permanent magnet, is bent into the form of a circle, with the opposite poles *NS* in more or less close proximity to each other, as shown in Figs. 2 and 3. This magnet *D* is seated in an annular depression in one of the partitions or walls *E* of the casing Fig. 1. The diaphragm, which is of some non-

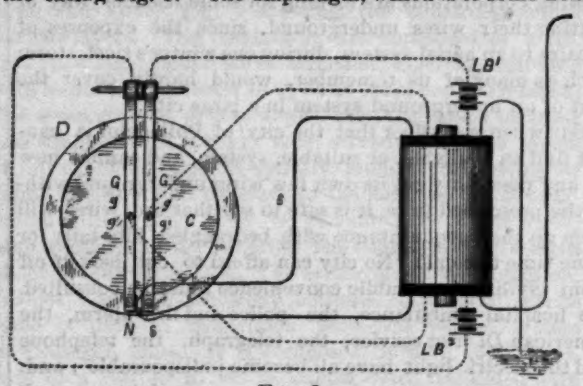


FIG. 3.

magnetic material, is mounted in an annular depression *f*, formed around the edge of the magnet on the side adjacent to the door of the instrument. The diaphragm is shown as carrying two insulated contact buttons or electrodes *g'*, against which opposite electrodes *gg* rest in contact. These opposite electrodes are mounted upon hinged or swinging arms *GG*, which are insulated and independently suspended from a support *H*, at the upper part of the instrument. These arms are formed of some magnetic metal, and are of such a length that their lower ends swing just opposite the poles *NS* of the magnet *D*, as illustrated.

A soft-iron screw or pole-extension *K* extends from each pole *N S*, and may be adjusted with relation to the end of the swinging arm *G* opposite to it, as shown in Fig. 1.

Each pair of electrodes *gg'* is included in an independent primary circuit, Fig. 3. For instance, the circuit from a local battery *LB'* runs to the upper end of the arm *G*, thence to electrode *g*, opposite electrodes *g'*, and by wire *lb'* to the induction-coil. The other circuit is from one pole of the local *LB²* to the other arm *G*, electrodes *gg'*, and thence to the induction-coil. These primaries are wound alternately with independent layers of the same continuous secondary, so that variations of resistance occurring between the two pairs of contacts *gg'* will both act upon a continuous secondary line for telephonic transmission. The attraction of the pole-pieces *K* upon the ends of the arms *G* maintains the electrodes *gg'* in contact under magnetic tension, so that they will not separate when a loud sound is uttered in the vicinity of the diaphragm.

The magnet *D* is formed with a groove *d* around its outside edge, as shown in Fig. 1, and in this groove is wound a coil of the secondary line *s*. This winding of the secondary re-enforces the magnetism of the permanent magnet *D*, and therefore intensifies the attraction of the pole-pieces *K* on the swinging arms *G*. This winding also adapts the instrument to use as a telephonic relay or repeater, as currents sent over the main line in transmitting from a distant station will traverse the secondary wire *s*, thus causing variations in the magnetic attraction between the pole-pieces *K* and the ends of the arms *G*, which results in variations of contact between the electrodes *gg'*. It is obvious that if the main line, instead of being wound in the induction-coil, be wound directly around the ring *D* and grounded, and the primary circuit or circuits be caused to act on another main or secondary line, the apparatus will act as a repeater.

Mr. Perrin has also patented various modifications of the instrument, all depending upon the same principle, however.

Subterranean Wires in Philadelphia.

It is now over eight years since the first ordinance of the Philadelphia City Councils granted permission to a telegraph company to place its wires underground; it is nearly five years since the first city ordinance was passed (Dec. 21, 1880) directing everybody owning overhead wires to have them underground by Jan. 1, 1885; it is two years since the city authorities tore down the wires of a company (the Postal) for its failure to bury them; yet, to-day, Philadelphia has over thirty separate corporations—telegraph, railroad, telephone and electric light companies and private firms—operating telegraph, telephone, electric light and "call" wires on and over the streets, making over five thousand miles of overhead wires. And how many miles of underground conduits are there, after all these five years of legal thunder and lightning? Just *seven* miles, in round numbers, one mile of which is inoperative.

Yet the law as amended demands that all lines shall be placed underground within the city limits by the 1st of next January; but experience would teach us that for some time at least the aërial lines will remain just where they are at present. Let us look back at the record for the past eight years and it will be seen that, after paying out the money to secure local legislation, the would-be underground people have done virtually nothing. The first ordinance passed by City Councils granting permission to tear up the streets for the purpose of burying wires bears date May 16, 1877. It allowed the Atlantic & Pacific Telegraph Company to lay and maintain underground wires in the city of Philadelphia. This company shortly afterward was absorbed by the Western Union Company, and never took advantage of its privilege.

In November, 1878, the Brooks Underground Telegraph Company was granted permission to lay a line of wires along Fifth street, between Chestnut and Cherry streets. These wires never were laid, although it has done work in other directions, as will be shown later on.

The Municipal Telegraph Company, in January, 1881, had an ordinance passed, but never laid either wires or conduits.

The National Underground Company was granted permission on March 16, 1881. A cable was laid on Market street, between Front and Juniper streets. It turned out to be a failure, and only part is now underground, the rest having been torn up by the traction company.

On June 21, 1882, the Brush Electric Light Company received permission to lay wires and conduits. A line was put down on Delaware avenue, between Vine and South streets, but it proved to be a failure. Such a failure was it, in fact, that, through some unprovided-for leakage, the intense current actually made *glass* out of the gravel surrounding the buried wires. It is hardly necessary to say that the scheme was abandoned.

On the same date the United States or Maxim Electric Light and Power Company also received permission, but never did anything.

The Underground Electric Conduit Company were allowed, on Feb. 7, 1883, to put wires under Juniper, Broad and Merrick streets and South Penn Square, but never did so, although the time in which it was to do it was extended by Councils.

A. C. Yates & Co. have laid about 500 feet on Chestnut, near Sixth. Permission was granted them on Feb. 7, 1883.

Henry C. Gibson and others, who use the Brooks sys-

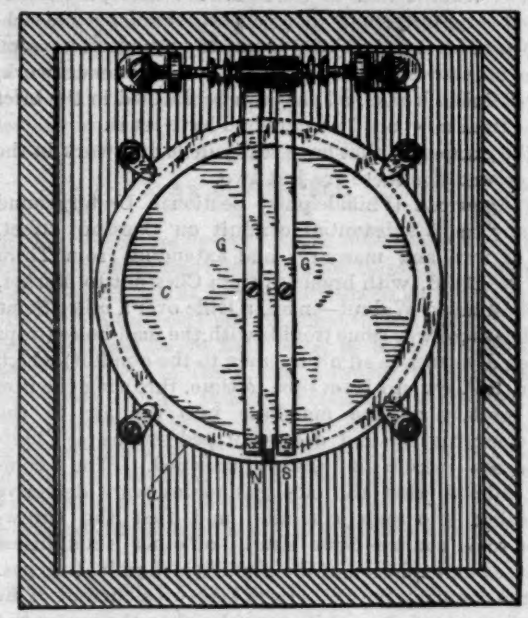


FIG. 2.—REAR VIEW OF DIAPHRAGM.

tem, were granted permission on April 3, 1883, and have laid about four miles of wire, running from the Broad street station to Front and Norris by way of Third and Walnut.

The Morse Underground Company were on Feb. 10, 1883, given until August 21 of the same year to lay a system of underground wires. It never did so, although it put down on private property 500 feet of wire for exhibition purposes.

On March 21, 1883, permission was granted to the Baltimore & Ohio Telegraph Company. As yet it has done nothing, but the officers of the company "expect to do something very soon."

A company, whose title was much longer than the wires it laid, the Metropolitan Underground Telegraphic, Telephone and Electric Light Company, received permission April 3, 1883, but never did any work.

The Philadelphia, Reading & Pottsville Telegraph Company were authorized to lay a wire between Nos. 204 and 227 South Fourth street, about forty yards, on June 29, 1883, and did so.

The Continental Underground Cable Company were given one year from July 7, 1883, to put down conduits and wires, but did not do so before the limit expired.

The Philadelphia Sectional Electric Underground Company were authorized on July 12, 1883, to lay wires and conduits, and have laid quite a substantial plant, which will be noticed lower down.

The Baxter Overland Telephone and Telegraph Company were authorized on Oct. 10, 1884, to lay wires and conduits on various streets of the city, but have done nothing yet.

Since then a goodly number of other permits have been given, and as the result of about, probably, two dozen schemes, with high-sounding titles, Philadelphia has to-day seven miles of underground.

A glance over the foregoing list will show the causes of failure.

All of these companies were required to enter $20,000 security to the city that they would not consolidate; that they would pay their taxes, keep the streets in repair, be responsible for damages, and obligate themselves in a number of other ways. Up to the present time the only companies that have complied with this provision are the Brush, Philadelphia Sectional and Henry C. Gibson & Co.

Of the companies that have fallen by the wayside, some have found the terms too hard and others have made an honest endeavor to inaugurate an underground system, and have discovered that their system was, under the conditions imposed, utterly impracticable. After the passage of the law giving due notice that all wires must go underground, the city itself was the first to announce that it could not possibly place the Police and Fire Department wires underground within the prescribed period; and, indeed, the city is to-day less prepared than any of the leading companies to bury its wires. The Western Union and the Pennsylvania Railroad (both of which companies are now working underground wires to a limited extent in the city) are loud in their protestations, and proclaim from the house-tops the faith that is in them, that they will adopt in Philadelphia, without regard to cost, any underground plan that will guarantee them perfect insulation. In September, 1884, the Western Union entered into a contract with the Brooks Electric Company to place underground for their use one hundred conductors, from their main office at Tenth and Chestnut streets to their branch office at Third and Chestnut streets (nearly a mile of the business portion of the town), and for twenty conductors from Third and Chestnut streets to Kensington Depot (about three miles under a similar territory), but for some reason the contract was never filled. The same company has now before the Councils of Philadelphia a petition asking for the right to lay a system of underground wires on Market street from Twenty-second to Fifteenth, thence on Fifteenth to Chestnut, to Third; on Third from Spruce to Vine; Chestnut from Third to Front, to Walnut and to the Delaware River, a distance of about three miles in the most densely populated and richest portion of the city. This company promises, as soon as the ordinance shall have passed, to commence work, and will finish, it says, all that can be finished in the brief period from now until winter shall have set it.

Of the companies that have really done any work in the underground line there are just two.

The American (Philadelphia) Sectional Underground Company has a substantial conduit on Chestnut street, built of iron and masonry, and extending from Third street to Broad, with branches from Chestnut to Market, and Chestnut to Walnut—in all, a trifle over a mile. Some time ago there was some trouble with the man-holes (traps at given distances to admit linemen to the conduit) which seemed to blow up from time to time, throwing the iron lid or grating of the man-hole into the air to the utter consternation and danger of pedestrians on Chestnut street, which is always crowded. The company claimed that the city gas mains were defective and leaked into their conduits, and that the throwing of some chance cigar stump or other thoughtless act caused an explosion of the municipal illuminating gas. Still, the company put in a fan to keep up a current of air through the conduit, and it was only when the current of fresh air blew volumes of gas out of the conduit at Third street, the down-town terminus, that the city set to repairing its leaky gas-mains. A rumor prevailed for some time that the "Sectional" had failed, like its predecessors; but the neat and effective way that it feeds the electric lights on Chestnut street every night, underground and with no wires in view, refutes that baseless rumor. The "Sectional" is still there. In this connection it may be said also that recently a cable railway, now building on Chestnut street, asked permission to be allowed to lower the "Sectional" conduit at certain points, so as to permit its own traction cable conduit to pass above the wires, which was granted, and that the excavation so necessitated, and the changes in the depth of the electrical conduit were responsible for the absurd gossip that the "Sectional" was being "carted off."

The other underground company which still holds its ground is the Electrical Construction and Maintenance Company (Brooks). This system has to-day 33 wires from Third and Chestnut to Front and Berks streets; 150 from Third and Chestnut to Broad street station; 33 from Third and Chestnut to Fourth and Willing's Alley, and 150 from Third and Chestnut to Walnut street wharf—in all about five miles of "pipe."

There is still a third line—that of the National Underground—extending on Market street, from the Delaware River to Juniper street, a distance of one mile, but although it has been classed in the seven miles of "underground" now in Philadelphia, it stands, or lies, only as a "frightful example," as many bleating lambs will testify. It cost a lot of money from the first, fell into disuse and has now been cut and hacked beyond recognition by the cable railway which recently laid a conduit on Market street.

But if we include this forlorn specimen of a wreck of an underground system, we can now present the following statement of underground lines in Philadelphia, as against the 5,000 miles of aërial lines, which include the city's own wires:

	Miles.
AMERICAN SECTIONAL (conduit), from Third to Broad, and short Branches	1¼
BROOKS (pipes filled with paraffine) Third and Chestnut to Tenth, Third to Kensington Depot and Broad street Station	5
NATIONAL UNDERGROUND (conduit), Market street from Delaware River to Juniper street (not in use)	1
Total	7¼

As a matter of fact, every electrician knows that our leading corporations are looking for some feasible way of getting their wires underground, since the expenses of repairs to an aërial system, during one winter's sleet storm such as many of us remember, would hardly cover the cost of an underground system in a large city.

But when we reflect that the city of Philadelphia cannot find an available, or suitable, system, and cannot now by any possibility get its own few wires underground within the prescribed time, it is safe to say that the wires will keep up their acquaintance with bedraggled kite-tails for some time to come. No city can afford to cut herself off from civilization. Public convenience must be consulted, the hospital ambulance, the police and fire alarm, the American District service, the telegraph, the telephone and the electric light have all become indispensable; and, for the next ten years anyway, we might as well insist that a poor fellow mangled on the railway should be hauled to the hospital underground as to rule that the ambulance alarm must in all cases follow a similar coursed. It would be as lawful, or at least as equitable, for a municipality summarily to order a man to tear down his mansard roof, because many people consider mansard roofs unsightly, as it would be to compel a telegraph company to bury it wires in such a way that they would not work satisfactorily.

"Underground" is coming sure enough, but not with a bound, and it behooves the various underground companies to come forward and demonstrate their merits.

PHILADELPHIA, Sept. 8, 1885. J. C.

The Multiple System of Switchboards.*

BY J. J. CARTY.

The multiple system is too well known to require description here, and the arguments for and against it have been heard so frequently that I need not repeat them.

In order to show what can be accomplished by the use of the system, I have thought it best to give some results already obtained from its working at Boston. Boston is chosen not only because it is the largest plant in operation and embodies all of the latest improvements, but because there some very difficult conditions were met, and a description of how these conditions were fulfilled will give a very good idea of the value of the multiple boards.

At one time the Boston Exchange consisted of one large central office, with a few small branch offices within the city limits. This state of affairs has changed during the past few years, owing to the rapid growth of the suburban business, so that to-day Boston has twenty-one branch offices, which include, with the central office, some 4,500 subscribers.

This multiplication of branch offices has been the cause of much unevenness in the service, which was expected to be materially lessened by the introduction of the multiple system.

The extra-territorial business also required special attention. Boston is within easy speaking distance of more than nine hundred thousand people. This means great possibilities for toll business, but its growth heretofore has been seriously retarded on account of the impossibility of giving it proper attention with the old apparatus. It was necessary that the multiple system should be sufficiently comprehensive to admit of handling a large extra-territorial business in the near future.

With the old boards but few more subscribers could be added on account of the lack of connecting strips. The multiple boards were required to have an ultimate capacity of over 4,000 lines, or more than double that of the other boards.

Of course, the introduction of the new system was expected to result in a great improvement in the general service.

Another important requirement was that the boards should be practically free from "cross talk," and that the cables furnished should be moisture-proof, because the air of Boston is unusually damp.

Still another requirement was that the work with the new boards be performed with fewer operators. Having named the conditions laid down, I will show how far they have been complied with.

After the boards were put in operation, there was a gradual improvement in the service for about a month, which was no doubt due to the increasing efficiency of the operators. At this time improvement ceased, leaving the service at a point far below the standard, and without effecting the desired saving of operators.

The principal difficulty was with the branch office service, and arose from the fact that when a subscriber wanted a branch office party, he gave the number to the central office operator, who had to repeat the call to the branch office. It frequently happened that while waiting for a branch office to answer, a number of calls came in, all of which were neglected until the central office operator got her answer and repeated the call. To avoid these annoying delays, subscribers were asked, when calling for a branch office number, to call for the office at which the number wanted is located, and having obtained that, give the number to the operator there.

When the subscriber became accustomed to the new way of calling, a great improvement was noticed, and it soon became about as easy to take care of a branch office call as one which was strictly local. This branch office business has been referred to somewhat at length, because it is the weak point in all systems, and should be carefully looked to by those introducing the multiple boards.

In order to get the best results from the multiple system, some means must be provided for an operator to throw off immediately all slow work, such as branch office and extra-territorial calls, message business, complaints, etc.

It is a very easy matter to do this, and a number of methods suggest themselves at once to any one who goes into the subject.

Let us now see how the extra-territorial business was provided for. For reasons already indicated, the extra-territorial business had not assumed the proportions warranted by the situation, yet about thirty-four lines had to be provided for at once, and arrangements made to accommodate more than double that number. To do this, the following plan was adopted:

Ten wire toll-boards were set up, to which the extra-territorial lines were led direct, without going through the regular switchboards. Each of these toll-boards was provided with cords and plugs connecting with a special switchboard presided over by a listening operator. Now, if an extra-territorial party wants a number in the local exchange, it is simply necessary for the toll operator receiving the call to telephone the listening operator, and have the line wanted plugged to the toll-board. In this way one switchboard can be made to serve ten or more toll-tables. In the case of a subscriber in the local exchange calling for an extra-territorial point, it is simply necessary for the local operator to plug the subscriber's line to a springjack which connects with the proper toll operator. The act of inserting the plug throws a drop on the toll-table, which is to be answered at once. The subscriber waits to give his call to the second operator, after which the connection is rung off by the toll operator from the local operator's table, and that ends the matter as far as she is concerned.

The actual connection with the extra-territorial line is made direct through the toll-room switch-board, only one pair of cords and one drop being in circuit, and is managed so that the drop can be shunted if desired.

The extra-territorial plant has proved a most satisfactory feature of the service from the beginning, and, owing to the improved work done, the toll receipts have considerably increased.

There is no reason why this system cannot be extended to an almost unlimited extent, and wherever a large number of toll operators are required it is especially recommended.

Owing to lack of space in the main exchange, a separate room had to be provided for the toll business. This is to be regretted, as experience clearly shows that the business for a long time to come can be better and more economically handled in one room than in two. Attention is called to this, as a separate toll-room has been recommended by some who claimed for it special advantages, none of which it is found to possess. As to the provisions for growth, it has already been shown that they are ample in the case of the toll lines; and in regard to the local wires, when we consider that the ultimate capacity of boards is practically 4,000, it seems enough to satisfy the demands of growth for some time to come.

In regard to the effect of the introduction of the multiple system on the service in general, it must be said that it has resulted in a gratifying change for the better: although there is still room for improvement, the service is very much superior to anything ever before known in Boston.

In connecting the boards, a very much larger amount of cable was used than in any previous installation, and grave fears were entertained of trouble from induction, retardation and leakage. Talking through the boards, however, proved to be better than before, and no trouble is experienced from any of the above causes, except when a loud-speaking transmitter is used, and then conversation can be heard on adjoining lines.

This is not to be wondered at, as the same, and even worse effects, have been observed on the so-called "straight" boards. This practical immunity from "cross talk" proves that the cable used is moisture-proof, and that the anti-induction appliances adopted are effective. The cable referred to is a form of Patterson cable known as the lead tape variety, so called from its envelope of lead tape or foil, which keeps out moisture and serves as an

* Read before the National Telephone Exchange Association, Providence, R. I., September 10, 1885.

induction shield, being connected to a ground. It is important to note that, although each line passes through eleven switchboards, the talking has not suffered, but has actually been improved. The fact of this improved talking has been noticed and commented upon even by subscribers. This result is obtained because the line is not obliged to pass through a drop on each section of switchboards, but is carried through a cable of high insulation, and whenever it appears at the face of a board, is led through a springjack which measures, contact and all, a very small fraction of an ohm.

It is well known that lines which pass through a number of ordinary switchboards never work well. This is for three reasons: First, there are always two or more drops in circuit, and it can be shown that the presence of even one electro-magnet in a line exercises a retarding effect on the current. Second, there are apt to be poor contacts caused by the plugs used in making the connection. Third, there is always more or less loss of current due to leakage.

The first two causes, as might be inferred from what has been said, are not present in the multiple boards, and no trouble is experienced from the third, because the total surface of eleven springjacks which is exposed to leakage is not equal to that offered by one line and connecting strips in an ordinary board. A comparison of the operating force of last winter, under the old system, with that of to-day, working the multiple system, shows a decrease of 25 per cent. in favor of the latter. The plant in the old office consisted of 34 50-wire and 5 25-wire Gilliland boards. There were about 1,650 subscribers, 90 branch and 30 extra-territorial lines. The extra-territorial lines were handled by five operators on the 25-wire boards, on each of which there were a dozen or so subscribers. This called for a force of 39 operators on tables at any one time, 7 operators for relief and 7 night operators, making a total force of 53. With the multiple system, only 20 operators are required to fill the boards in the main exchange, with 5 relief and 4 night operators. In the toll-room, 11 operators are required, including the chief, 1 relief and 2 night operators. This makes a total of 40 operators handling 1,700 subscribers and 152 trunk lines, and shows a saving of 13 operators. The present equipment will accommodate 200 more subscribers, and if it is not found necessary to add more operators when the boards are full (and the indications are that it will not), a still further saving of two operators will be made.

From the fact that the operators at the new boards were obliged to care for a larger number of lines than before, it was feared that they would not be able to work the required number of hours, and would have to be frequently relieved. This has not been the case, however, as owing to the comforts with which they have been surrounded, and the remarkable ease with which connections can be made by the new system, the operators have really a much easier time than before. How much work an operator can do at a multiple board in a day is an important question for those about to adopt the new boards.

At Boston, operators frequently attend to 700 calls a day, and think they could make 900 without any hardship. At Pittsburgh, 750 calls a day is considered very good work, and about 700 calls a day are being made at Louisville; but the manager there thinks this number could be increased several hundred without overworking the operator.

The New Orleans people consider 1,500 calls a fair day's work for an operator at their boards, while at Indianapolis the number is set at about 1,000. Twenty-two hundred and twenty-six calls were made by an operator at the Nashville boards the other day, and she was not the most expert operator, neither was it a busy day.

Two of the objections most frequently urged against the multiple system are breakage of cords and poor contacts of springjacks. Out of eleven hundred cords in use since May 1, but three have been broken, and they have been repaired and are now in use. The cords used are a combination of tinsel and spiral wire, suggested by Mr. Keller. But two faulty contacts have occurred in twenty-seven thousand springjacks, and those resulted from accidents.

It is a fact not generally known, that the present form of multiple board can be used for metallic circuits without any radical changes.

The Value of Bell Telephone Stock.

The American Bell Telephone Company has declared a quarterly dividend of 3 per cent., payable Oct. 15. A believer in the company writes:

"Touching the matter of telephones, it has recently been stated that the output has increased slowly during the past six or eight months, being but a few thousand, with the chances for a large proportionate increase for the balance of the year still in doubt. Notwithstanding this fact, we find upon inquiry that the company is earning 20 per cent., even if there should not be another telephone added the balance of the year. Their recent action toward the sub-companies must enhance the value of their large holdings in those companies, making the value of the stock less dependent upon its earning capacity, which heretofore has been considered its chief asset. The time must come when such large earnings will be better appreciated. At to-day's price Bell stock is selling at less than 60 on the basis of 6 per cent. earnings. It would be difficult to find a property on public sale, with such earnings, selling at such a price. Compared with Eastern railroad stock selling at 53 and New York & New England Railroad at 23, the dividend prospects of which have been well discussed, the price seems ridiculously low. Truly, it seems at times that it is the amount of attention given to a security by the brokers which makes or unmakes its market (not its intrinsic) value."

Telephone Cables.

Long-distance telephony and telegraphy frequently require the lines to cross rivers, marshes, etc., and for that purpose special cables have been constructed, Our illustrations show the excellent cable made by Mr. A. G. Day, which has been adopted by numerous telephone and telegraph companies engaged in long-distance work. Fig. 2 is an end view, Fig. 1 showing the construction and various layers. The conductors are composed of 3 No. 18½ B. W. G. copper wires stranded together, insulated with kerite to a diameter of $\frac{5}{32}$ of an inch, and then taped. The seven strands, or conductors. are then cabled together and wrapped with a heavy tape, served with three layers of jute packing, put on spirally, each layer having its spiral in a direction contrary to the last; the whole is armored with 18 No. 4 B. W. G. galvanic iron armor wires, each weighing 810 lbs. per mile. The complete cable weighs about 10 tons to the mile. The armor is a great protection. against abraision on rocky bottoms. An aërial kerite cable is used in connection with the village system in Leicester, Mass. It is composed of nine conductors, each of a No. 18 B. W. G. copper wire, insulated with kerite to $\frac{1}{32}$ of an inch. The Baltimore & Ohio Company, the Bankers & Merchants' Company, the Postal Telegraph and Cable Company and the Western Union Company, as well as the American Telephone and Telegraph Company, have these heavily armored cables in use. The experience with them is that they are remarkably durable and give great satisfaction.

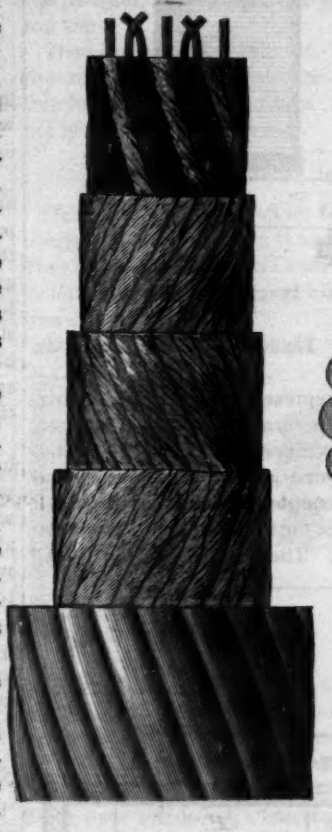


FIG. 1.

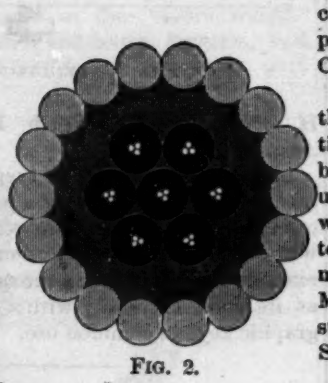


FIG. 2.

KERITE INSULATED TELEPHONE CABLES.

Wires West of the Missouri.

In an interview recently, President Bates, of the Baltimore & Ohio Telegraph Company, gave the following information concerning the monopoly which has grown out of the telegraph franchises included in the railway concessions received by certain Western roads from the government:

"At this time," began Mr. Bates, "when so much ha been said regarding the control by one corporation of the entire telegraph business of the country, it may be interesting to recall the fact that the Western Union Company claims to exercise exclusive telegraph privileges over the Union Pacific and other land-grant railroads west of the Missouri River, notwithstanding the charter and obligations of those railroad companies. Judge John F. Dillon and Sidney Bartlett, counsel for the Union Pacific Company, at the request of that company, rendered an elaborate opinion on Feb. 22, 1880, clearly showing the duty of the railway company in this respect to be the operation of its telegraph lines free to all.

"Five years ago, when Mr. Gould was in control of the American Union Telegraph Company and his interests were identical with the Union Pacific Railway Company, he apparently was very anxious that the Union Pacific should live up to its government obligations and operate its telegraph lines 'free to all,' particularly to the American Union Telegraph Company. President Sidney Dillon, who was also a director of the American Union Company, sent the following notice to his telegraph superintendent:

"NEW YORK, March 1, 1880.

"*J. J. Dickey, Omaha:*

"Have just served formal notice upon the Western Union Telegraph Company (referring to the aforesaid letter of mine of Feb. 27, 1880, to the Western Union Telegraph Company, Schedule A of answer), stating that the railway company would itself operate and use its telegraph lines, placing all companies and persons upon equal footing, giving equal rights to all and exclusive or favored privileges to none. You must see that this is carried out in letter and in spirit. SIDNEY DILLON.

"The Western Union Company, however, obtained an injunction from the courts, and before decision was finally rendered the American Union and the Western Union companies were consolidated. Since that time no demand has been made upon the Union Pacific Company until about a year ago, when the Baltimore & Ohio Telegraph Company opened up correspondence with President Charles Francis Adams, beginning in August, 1884, and ending in February, 1885, the intervening time apparently having been occupied by Mr. Adams in what might be called skirmishing. In February a resolution by the United States Senate was passed calling upon the Secretary of the Interior to inform the Senate whether the Union Pacific Railway Company and the other land-grant railroads had constructed and were maintaining and operating their telegraph lines without discrimination, as provided in their charters. The then Commissioner of Railroads, W. H. Armstrong, notified the Baltimore & Ohio and Western Union companies that he was prepared to hear arguments upon the questions involved, and at the appointed time, Feb. 27, the hearing took place, Judge Jere Wilson appearing for the Union Pacific Company and Gen. Wager Swayne representing the Western Union contract with that company. At this hearing the true inwardness of the relations between the Western Union Telegraph Company and the various land-grant railroads was disclosed, and the entire correspondence, including all the contracts in question. The arguments of the several companies *pro* and *con* were submitted to the Senate and printed as an Executive document (see No. 2, Forty-ninth Congress, special session).

"A reference to this document by those interested in the subject will throw a great deal of light upon the questions involved. The time was too short for further action by Congress during the session then about closing, but it is understood that the subject is being revived, and that when Congress meets in December one of the earliest matters to receive attention will be the relations of the government and the public to the telegraph lines west of the Missouri River along the land-grant railroads and constructed with the money and the credit of the United States government."

An Electric Eel.

An electric eel, the first of its kind ever brought to this country, is now in this city. It came from Brazil, in the waters of which it is at home, and is about three feet long. It differs from the eels found in these waters by having no continuous dorsal fin, its back being perfectly smooth and round. In place of the dorsal, however, the *Gymnotus electricus* has a long anal fin, extending on the ventral line from the throat to the tail. The head is shaped something like that of a catfish, and is provided with two very small but very brilliant eyes. The color is of a muddy brown, speckled on the sides with bright red spots, and the lower side of the head is also of a reddish tinge.

The Financial Telegram Company of Boston.

This is a stock quotation company organized and controlled by the Commercial Telegram Company of New York, with Mr. R. F. Strain as President and George D. Edridge as Treasurer. It has been organized for some time but not till recently have any active steps been taken to open for business. The central office, located in the basement of the Rialto Building, corner of Milk and Devonshire streets, is in charge of Mr. L. Derrick, of New York, Mr. J. E. Wilson having charge of all the circuits outside. At the central office is a 25 h. p. Armington & Sims engine, driving a counter-shaft extending the length of the building, to which are coupled two Healy compound dynamos. It is very essential that a constant E. M. F. should be had to work more than one system, and these machines regulate themselves so closely as to allow the use of Edison lamps, fed from them, to light the rooms when necessary, without the slightest tremor of the light when the load is thrown on or off the dynamo. The dynamos are of the same style as that which has been used in Philadelphia at the station for two years with the best results.

The operating room is connected by direct wire through the United Lines Telegraph Company to their New York Central office. Thus the stocks are received in Boston simultaneously as sent from the Exchange. It is the intention of the company to give the best service possible. The Field "Ticker" used is well known in New York, combining the joint inventions of S. D. Field and Clarence L. Healy, with perfect automatic control of the keyboard and transmitter, which gives to this system its high speed and durability.

A Change in the Name and Form of "The Operator."

(From *The Operator*, Sept. 19, 1885.)

After this issue, *The Operator* will appear in a new form, and will appeal to the telegraphic profession principally as a literary paper. This has been the pet idea of some of our leading telegraphic writers for years. Mr. Walter P. Phillips, Mr. Joseph Christie, and, among many others, the editor of this paper, have stoutly maintained that a cheap literary paper, such as we propose to make out of *The Operator*, would be very acceptable to the better class of telegraphers. The name of *The Operator* in its new form will be "*Johnston's Journal: An Illustrated Magazine for the People.*" It will be profusely illustrated by the best artists, and contain articles of all kinds by leading writers, and as the entire staff of editorial writers of *The Operator* will continue to labor as assiduously for the paper in its new form, we believe that our old friends will take pleasure in reading their work in the higher and broader fields to which they betake themselves. The changes we propose will make the paper very interesting to the public in general as well as to members of our profession ; and the latter will, we feel satisfied, take an especial pride in seeing the work of their fellow-craftsmen ranking before the world with, and perhaps in some cases above, the literary work of our leading professional writers.

One of the minor reasons for the change is that we have found by experience that THE ELECTRICAL WORLD and *The Operator* conflict to a certain extent, the advertisers of electrical goods preferring to reach the public through the first-named paper. As for miscellaneous advertising, we have, as our readers know, exercised such a rigorous censorship over them—notices of learners' instruments, telegraph schools, etc.—that the field left was very small. Another sufficient reason for the change is found in the large space which we now devote to telegraphic matters in THE ELECTRICAL WORLD and hence the necessity for publishing a separate telegraphic paper no longer exists. Besides, *The Operator* only gave such matter every other week, while THE ELECTRICAL WORLD appears every week, and, in addition to its mass of purely telegraphic science, news and gossip, it keeps its readers informed of everything that transpires regarding telephony, electric lighting and all the other multifarious outgrowths of telegraphy. THE ELECTRICAL WORLD having thus become a cosmopolitan electric journal, and one which no ambitious and enterprising telegrapher can afford to miss, we think the time has arrived for *The Operator* to branch out and address the world at large, as well as its telegraphic constituents who have stood by it for over eleven years.

In its new sphere, and under its new name, *The Operator* will, of course, have a much wider field of usefulness, and it will be the chief endeavor of all connected with it to make it as satisfactory to its large range of readers as it has been in the past to the class to which it addressed itself particularly. Its columns will always be ready to champion the cause of the operator before the entire reading public. Of its excellence we shall leave our readers to judge for themselves. Its reading matter, its illustrations and its typography will all be of the very best, and, in fact, its merit will be such that we hope that not only will all our old patrons renew their subscriptions, but that those of the Old Guard will be able to secure a large number of subscriptions from their non-telegraphic friends.

It is a pleasure to us to know that *The Operator* was never better than it now is, and was never more highly appreciated. Several times during the present year we have been complimented orally or by letter or by our exchanges on the excellence of the paper. Thus Mr. E. B. Pillsbury, a well-known telegrapher in Boston, sent us the following unsolicited eulogy on Sept. 2 : " I have been a constant reader of the paper since its birth, and it has never given me so much pleasure as during the past year."

In case subscribers to *The Operator* do not care to take *Johnston's Journal*, their terms will be filled out with THE ELECTRICAL WORLD, which now, with its average of ten pages of reading weekly, gives far more matter of interest to telegraphers than it was possible for *The Operator* to do. Moreover, the subscription to THE ELECTRICAL WORLD is $3 per annum, while *The Operator* is only $1. We thus will more than make good our contract. But we strongly advise our friends to take both papers, or even, if they can afford it, *Industrial America* as well. The three papers cover the whole range of contemporaneous thought and action in a bright, fresh and instructive way, helpful and beneficial to every reader of them.

Wired Love.

A dispatch of Sept. 12, from Dayton, O., says that a romantic love affair, terminating in a wedding, has come to light there. During the strike of Western Union operators, two years ago, a lady operator, Cora Lennox, was taken there from Union City to take the place of a striker. No one was quicker to perceive her good qualities than Lawrence E. Moones, an operator at the Cincinnati end of the wire. He seemed to know from the click of the instrument that a pretty girl was at the other end, and soon the wires were used by the two to talk love.

They were so well manipulated that recently Mr. Moones took a trip to Dayton to make the better aquaintance of the girl, and on the 29th of last month he went back to Dayton, procured a marriage license, and made the charming operator Mrs. Moones. The wedding was private. Mrs. Moones has tendered her resignation as operator, and will soon join her husband in Louisville, where he accepted a place as telegraph operator a few days ago.

Telegraphing Without Batteries.

For some weeks past we have received numerous inquiries regarding an invention which, it is claimed, will revolutionize telegraphy, and cause the abolition of all batteries in telegraph work. The daily papers have also taken up the subject, far and wide, and have thus aroused considerable interest in the invention. The names of all the leading capitalists in the country have been associated with it. In order that our correspondents and readers generally may have an opportunity of judging the invention, we give a description and illustrations of it, as they appear in the patent. The latter is granted to Frederick

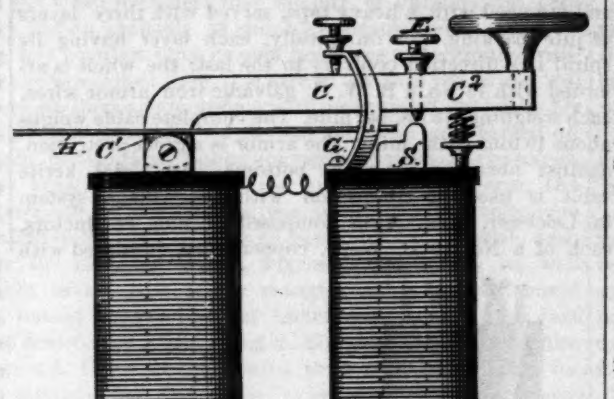


FIG. 1.—SENDING INSTRUMENT.

H. Brown, of Fort Worth, Texas, and was issued on Aug. 18.

In our illustrations, Fig. 1 represents the sending instrument, which is composed of a permanent U-shaped magnet, on the poles of which are wrapped helices of insulated wire. A key *C* is pivoted to one pole of the magnet, and extends over and beyond the opposite pole, being provided at its outer extremity with a button similar to the telegraphic keys in common use. The pivoted end portion *C'*

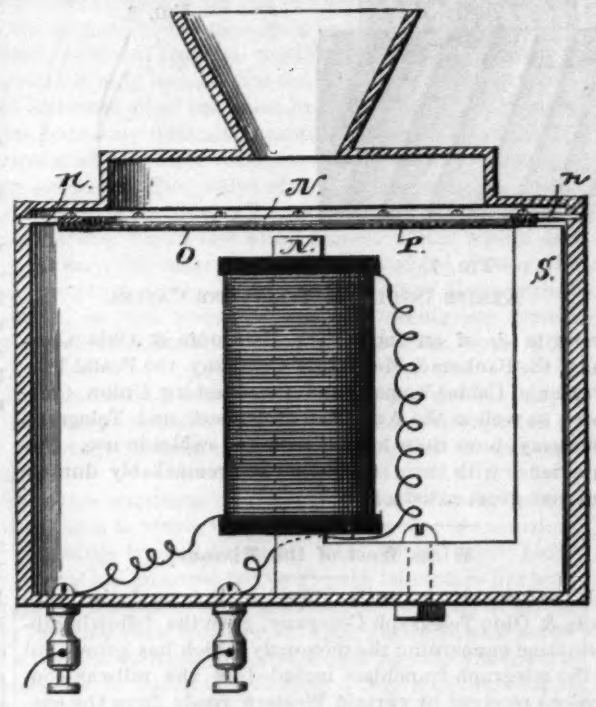


FIG. 2.—RECEIVING INSTRUMENT.

of the key is made of soft iron, and the extended arm portion C^2 of brass.

E represents an adjusting-screw, which is made of iron, and which passes down through the key *C*, its lower end being normally nearly in contact with the pole *S* of the magnet.

A disc *H*, which is made of thin sheet-steel, is permanently secured to the pivoted end of the key, and extends horizontally over the poles of the magnet, as shown.

The receiving instrument shown in Fig. 2 consists of an inclosed case provided with a mouthpiece. Within the case there is secured a permanent U-shaped magnet, the south pole of which is at one side of the inclosing-case, while the north pole is directly in line with the centre of the case and its mouthpiece. On the north pole of the magnet is wound a helix of fine insulated wire, while the south pole is left bare. The ends of the helix are secured to the binding-posts, to which the wires from the sending station are connected.

A ring *N* is provided with a number of projections *n*, which are let into the case, and to the ring is secured the disc *O*, of sheet steel. This method of attachment allows of free air space between the upper and lower sides of the disc. The south pole of the magnet is in contact with the north pole or outer edge of the magnetized disc, and the north pole of the magnet is directly under the centre of the disc, but out of contact.

By this construction it will be plain that the centre of the disc *O* is free to vibrate.

The key of the sending instrument is operated, as usual, so as to tap off the dots and dashes as used in the telegraphic code (Morse). As the key is depressed it comes in contact with the south pole of its magnet, and thus closes the magnetic circuit, and the jar consequent upon this impact sets the disc, which is secured to the key, in vibration in consonance therewith, and produces a resonant tone. The vibration of the sending disc induces an electric current, which is transmitted to the receiving instrument, and the vibrations of the sending-disc are reproduced by the disc of the receiving instrument and the case, acting as a resonator. It will be seen that the system is a combination of the telegraph and the telephone, the latter being substituted for the sounder.

As regards telegraphing without main line batteries, the invention cannot be called new, as this has been accomplished before by the use of Siemens and Halske's well-known induction key. The present sending instrument is an ingenious modification of the former, both generating magneto-electric currents by the motions of the key.

Funny Telephone Trouble.

BY CHAS. E. LEE.

In the early days of the telephone I was called to investigate a new circuit which, in spite of the care which the wire carpenter alleged had been spent on it, remained very open.

I of course proceeded to the subscriber's end of the wire and found that everything was in beautiful condition apparently, the wires carefully and skillfully brought through the window and to the instrument, but in following the ground wire it was found that this brilliant disciple of lightning had taken for his ground an *iron spittoon* which stood conveniently near. He had carefully filed one of the handles, and had soldered the wire so as to make a sure enough connection, but it was a very poor ground nevertheless.

The superintendent of the exchange took it into his head to put in an instrument himself one day, one that was wanted in too much of a hurry for the regular force, who had their hands full with previous orders. He used about as much care as the spittoon man with his ground, with about as good a result. He soldered his ground wire to a lead waste-water pipe, which looked regular enough on the inside, but was a delusion as regards "ground" qualities, as it simply ran through the side of the building and was in contact with nothing in particular except air. One of the regular force had to go up and repair the "break."

A railroad agent whom a great many people in western New York know, once had occasion to make some changes in his office which involved the removal of a gas fixture. One of the men called his attention to a wire which was fastened to it, and he very ingeniously got over the difficulty by having one of the carpenters drive a staple to which the wire was carefully fastened. It is needless to remark that the "phone" at that office was immediately out of order.

Some curious and laughable faults occur occasionally when ignorance or carelessness can hardly be charged against any one. I had a case at one time in which a mysterious ground appeared frequently on a line, and which defied all investigation, for it generally disappeared as soon as the inspector arrived at the subscriber's place of business. So provoking and persistent was this trouble that the irate merchant ordered them to put it in order or else take the "dum thing out."

I went down, determined to stay there till something turned up, and took a chair where I could watch the whole outfit. After a siege of half an hour, the book-keeper opened the big safe, which had been carefully closed when the suspicious-looking telephone fellow came in, and the situation was immediately illumined. If any inspector had been permitted to see that safe in its open condition, he would have instantly seen where the sharp corner of the iron door had cut its way through the covering of the wire and made all the trouble.

I built a circuit of only two or three stretches of wire once for an Edison exchange, which developed the most provoking cross I ever experienced. It was crossed with a circuit of the Bell Company's system—a line which ran to a public telephone office. Although every position of our wire could be seen from the tower right down to the subscriber's window, and although it did not come within fifty feet of the Bell wire, the "shutter" was continually dropping when it ought not.

We found at length that the cause of the disturbance was the fact that both wires were grounded to the same system of gas pipe, although at opposite sides of a large block, and an imperfect joint made high enough resistance to deflect a large share of the current to our line. By going to a new ground we found the trouble ended.

The Siphon Recorder.

Sir William Thomson's patent for his siphon recorder expires this year, and it is probable that the instrument will come into greater use than hitherto. The introduction of permanent magnets for the large electro-magnets originally used to produce the magn etic field of the signal coil will probably be extended, and there is also a prospect that the troublesome "mouse-mill" will be obviated. At all events, Mr. Pescad, an employé on the Central American cable lines, residing at San Juan del Sur, has invented a plan which reduces the friction between the marking siphon and the front of the paper without the necessity of electrifying the ink by means of the mouse-mill. This plan has been tried successfully for some months on a cable about 1,600 miles long on the Central American coast. The plan consists in vibrating the siphon in such a manner that its point "jumps," as it were, on the paper. This is done by attaching a thread to the fibre, which suspends the signal coil about two inches above the latter. This thread runs behind the recorder at right angles to the suspending fibre, in a horizontal direction, and is connected to the hammer-contact of a small induction coil. When the coil is started by a battery the vibration of the hammer pulls upon the thread and vibrates the siphon connected to the signal coil, so that the point of the siphon rises and falls on the strip of traveling paper. The movement is, of course, very minute, but it is sufficient to diminish the friction between the siphon point and the moving paper without interrupting the fine ink li ne which the siphon marks upon the paper. Mr. Pescad states that this line is as good as the line made by the siphon of a recorder with electrified ink. The introduction of this plan, together with permanent magnets, would render the large-tray Daniell batteries used with the recorder no longer necessary to its working.

The "Underground Wire Commission" No Misnomer.

As announced by us already, the United States Illuminating Company, of this city, was obliged to abandon its station in Forty-fourth street to make room for the new depot of the New York Central Railroad. Having removed the station to Twenty-ninth street, it recently applied to the Underground Commission for permission to erect poles and run lines in connection with the new station. The application being held under advisement, Mr. Squire, the Commissioner of Public Works, appeared before the commission last Monday on behalf of the company, and asked that it be allowed to resume its interrupted business.

Mr. Loew informed Mr. Squire that the land in Forty-fourth street was not taken from the United States Illuminating Company, but that that corporation voluntarily sold it to the Harlem Railroad, with a full knowledge of the fact that no more wires were to be allowed overhead. "If we yield an inch of ground in this case," said Mr. Loew, "numberless other applications of the same kind will come pouring in, and the result will be that we shall become an overground instead of an underground commission. If the question is brought before the board, I shall certainly vote to maintain the position that we have already assumed."

Mr. Moss expressed the same views, saying that he would never give his consent to the placing of another pole in front of any man's house.

On motion of President Loew, a resolution was passed giving to inventors and others until Oct. 15 to present and explain their designs. Gen. Averell, of the Averell Insulating Company, was given a further hearing on his conduit of silica and asphaltum, a model of which was presented to the commission last week. The General estimated roughly that a system to accommodate the city would require 20 miles of main conduit, 40 miles of branches and 340 miles of "twigs." He said that Fourteenth street alone was crossed now by 1,444 telegraph, telephone and electric light wires.

W. C. Barney, of Washington, claimed that he had invented a wire which was free from the influence of induction.

Report of the Brooklyn Underground Wire Commission.

The first report of the Electrical Subway Commission of Brooklyn was handed in to Mayor Low this week. It is a very long document, and begins by stating that, after 29 meetings of the commissioners, they have as yet found it impossible to announce a solution of the problem of underground electrical conductors throughout the city of Brooklyn, which shall be thoroughly practicable and entirely satisfactory and complete. Of one possible solution submitted, the report says that nothing would be as good as a properly constructed tunnel, of sufficient size to admit the passage of workmen and access to the wires within it. Another sub-committee of the same general committee reported that there was no law under which such a tunnel could be constructed. The cost, too, it was thought, would be very great, especially in a city like Brooklyn, where the distribution of lateral conduits would be a difficult task.

The conclusions arrived at by the committee in regard to the underground electrical conductors are that the cost of underground wires is more in the beginning but less for current maintenance than overhead wires. Besides this, the report says that no substance used as an insulator underground has proved invariably and perfectly permanent. The gutta-percha covering, apart from the high cost, is deemed the best, but of late the gutta-percha has failed in some instances. The board approved of a plan submitted by the New York and New Jersey Telephone Company. The plan is to lay conduits of creosoted timber boxes, with partitions, on Fulton street from De Kalb avenue to the City Hall, and below the City Hall, either in Fulton or Washington street, to points to be hereafter determined. The boxes were described in THE ELECTRICAL WORLD some time ago in an article on the Brooklyn telephone system. The Western Union and Gold & Stock Telegraph companies have signified their willingness to place their conductors along the above-mentioned route. Accommodations are to be made in these conduits for police and fire telegraph lines. The board is of the opinion that creosoted wood would be injurious to the gutta-percha on the wires, but lead pipes would remedy any defects that may be caused by the creosote.

Photographing a Theatre by Electric Light.

In order to celebrate the seventh anniversary of the opening of the Novelty Theatre in Williamsburgh, L. I., the proprietors determined to have the theatre with its audience photographed, and to present each one present with a copy as a souvenir of the occasion. In order to carry out this idea the aid of the Municipal Electric Light Company of Brooklyn was solicited, and they carried out their part of the work in a most satisfactory manner. There were 21 Thomson-Houston arc lamps distributed through the house in the following manner: Nine were suspended above the foot-lights, five above the centre of the parquet, four under the balcony and three along the top tier.

The photographer, Mr. H. W. Biffar, was situated on the stage and took four plates between the third and fourth acts. The steadiness of the light was remarked, not less than its brilliancy.

Paraffine Insulators.

Our illustrations show two forms of the Brooks paraffine insulators, Fig. 1 being known as the "screw shank." They are largely used in Central and South America, and in East India, Australia and Africa, in connection with iron poles.

The cross-arm insulator shown in Fig. 2 is that used by

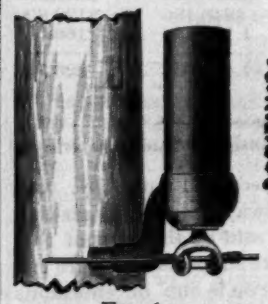


FIG. 1. POLE INSULATOR.

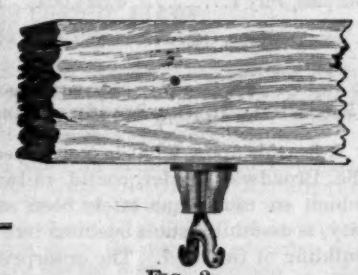


FIG. 2. CROSS-ARM INSULATOR.

the Pennsylvania Railroad and its leased lines, on which it is found to give excellent results. On this road there are as many as 40 relays in a circuit of 135 miles between Altoona and Harrisburg. Each of their three divisions being over 100 miles in length, with so many relays averaging 200 ohms each, in circuit, it is impossible to work the lines in foggy or wet weather with the ordinary glass insulators. Hence these paraffine insulators have been employed. Their use also permits of a smaller wire being employed, as the insulation is very high.

As shown in the engraving, the bottle of clear glass is left bare where no strength is required. Besides its use on telegraph lines, the insulator is eminently adapted to electric light work, its excellent qualities in wet weather making it most valuable for that purpose.

Experimental Plant of Brush Incandescent Dynamos and Storage Batteries, at Cheyenne, Wy.

The above company, as well known to our readers, has had over one hundred storage batteries in use for a long time. Believing, however, that the current for the business portion of the city could be more cheaply supplied by dynamos direct, they decided to erect a station in the heart of the city for this purpose, and to further assist the economical working of the plant, removed all the arc machinery to the same place.

In order to fully test the incandescent dynamo of the Brush Company they rented a shed in the heart of the business quarter, and placed therein a semi-portable engine, 8 by 10 inches, running a 450-light dynamo, though not of course to its full capacity. One hundred and fifty lamps, located in various places, were connected to the dynamo, and have been running for one month with satisfactory results. The dynamo is run from dark until midnight, and the current for the remainder of the night and for the day is furnished from storage batteries placed in the same shed as the engine. The batteries can be switched on the line and the dynamo thrown off with only a "blink" in the light. Most of the lamps are over 700 feet distant. One hundred volt lamps are used. The company have given the contracts for the machinery for a very complete lighting station, in which will be arc and incandescent dynamos and storage batteries. We will give a full description of the same when completed.

The Clambake of the Year.

The seventh annual clambake given by the American Electrical Works, Providence, R. I., to the electrical fraternity, took place at the Vue de l'Eau Club, Narragansett Bay, on Friday, Sept. 11. A finer day could not have been wished for, and the party was one of the largest and best-humored that has ever met to enjoy the free-handed and warm-hearted hospitality of Messrs. Phillips and Sawyer. The following is the list of gentlemen in attendance:

NEW YORK.—Clark B. Hotchkiss, H. M. Williams, Chas. J. Klein, C. E. Stump, J. A. Seely, James Kempster, W. R. Frary, W. L. Candee, Geo. B. Speer, G. M. Robertson, Jno. B. Underhill, Ralph W. Pope, J. S. Morse, J. A. Wetmore, H. L. Bailey, F. B. Knight, E. A. Leslie, W. M. Goodyear, J. H. Bunnell, C. R. Truex, G. L. Wiley, Chas. W. Price, J. W. Marsh, M. E. Hunter, T. C. Martin.

BOSTON.—Henry J. Miller, H. S. Thornberry, C. J. Sheehan, J. J. Carty, J. H. Clarke, F. P. Canfield, F. M. Lytle, Charles L. Bly, Loren N. Downs, W. A. Hall, George W. Adams, J. C. Kingston, E. W. Metcalf, R. S. Boyd, George T. Manson, F. A. Hannaford, C. A. Perkins, Morgan Brooks, E T. Gilliland, J. J. Williamson, H. B. Lytle, M. S. Lewis, W. M. Smith, H. J. Pettengill, N. W. Lillie, P. Fahey, T. C. Frenyear, Geo. W. Blodgett, Albert Howard, Rufus B. Carr, W. B. Learned, C. C. Allen.

PROVIDENCE.—Eugene F. Phillips, W. H. Sawyer, W. S. Crofut, L. W. Breckenridge, A. C. White, R. H. Whittier, Chas. T. Howard, V. A. Thomas, F. H. Gardiner, F. T. C. Busnell, E. M. Carhart, Geo. W. Millard, W. W. Dempster, Geo. H. Darling, Chas. E. Lincoln, B. L. Allen, A. Wright, E. F. Phillips, H. C. Bradford, J. W. Duxbury, Gardiner C. Sims, L. Burdon, R. T. Robinson, E. H. Howard, P. J. Hurlburt, H. C. Cranston, Abiel F. Davis, W. W. Douglass, Jno. I. Drake, W. H. Joyce, W. N. Munro, H. C. Langstaff, J. H. Chace, J. M. Addeman, C. G. A. Peterson, Henry H. Sherman, F. H. Angell, J. O. Darling, W. A. Hathaway, C. R. Remington, Jr.

BROOKLYN, N. Y.—C. S. Thompson, W. D. Sargent, J. C. Reilly.

NEW BEDFORD.—W. K. Wagner, R. S. Taber, J. W. Pratt, W. R. Sherman.

PHILADELPHIA.—H. H. Levett, Frank Reise, W. W. Bair, C. B. Phipps.

CHICAGO.—B. E. Sunny.

WATERBURY.—A. M. Young, A. O. Shepardson.

NORWICH, CONN.—J. Jepson.

BRIDGEPORT.—T. B. Doolittle.

FALL RIVER.—Chas. Sylvester.

WORCESTER.—W. H. Willard.

NORTH ADAMS.—W. H. Stedman.

ATTLEBORO.—W. M. Fisher.

LOWELL.—M. G. Parker.

TAUNTON.—D. L. Mitchell.

VALLEY FALLS.—J. C. Wyman.

BRADFORD.—F. A. Newell.

WILLIAMSPORT, PA.—A. M. Bailey.

HARRISBURG.—Wm. Ker.

NEW HAVEN.—E. B. Barker.

NEW ORLEANS, LA.—J. J. Fowler.

PAWTUCKET.—Ellis F. Frost, R. D. Mason, Isaac Shove.

CINCINNATI.—Geo. N. Stone.

BALTIMORE.—A. Wilson, Jr.

WASHINGTON.—Fred W. Royce.

SPRINGFIELD.—F. G. Daboll.

NEWTONVILLE, MASS.—P. G. Burgess.

BARRINGTON, MASS.—J. U. Starkweather.

JERSEY CITY, N. J.—C. H. Barney, Sec'y Nat. Tel. Ass'n.

ALBANY, N. Y.—W. H. Crill.

RUSSIA.—John. Crawford.

LONDON, ENG.—Henry Edmunds.

The guests proceeded from Providence early in the morning, and an excellent lunch was served soon after the arrival at the club grounds. Then various amusements were indulged in according to the disposition and tastes of each one present. A game of baseball attracted much attention. The captains were Mr. J. O. Darling, of the American Electrical Works, and Mr. F. B. Knight, and the result was in favor of the Darlings by 42 to 13. Foot-ball was also liberally indulged in, as well as archery, rifle shooting, lung testing with an automatic flour responder, cards, and the like. About 2 P. M. a local photographer "took" the whole party in a large group on the piazza of the club house. When the negative was examined, the gentlemen who showed up well said they had never seen a better piece of photographic work, but those who appeared to disadvantage thought the artist a very poor one. It was generally conceded that the clam held aloft by one gentleman in the group came out more lifelike than anybody else.

Each of the guests as he arrived was requested to sign the register, and was then presented with a very neat and handsome cane, the head of which was a Bell telephone receiver, bearing plates commemorative of the event. A silver clam was attached to the binding posts by fine insulating cord. Several telegraph men remarked feelingly as they accepted the tasteful gift that they had lately become accustomed to being placed in the hands of a receiver, and that it was an agreeable sensation to have a receiver placed in their hands instead.

The "tocsin of the soul" announcing the bake was heard with shouts of approval at 3 P. M., and places were at once taken around the festive board. Mr. Eugene Phillips, presiding with his wonted ease and urbanity, read letters from Governor Wetmore, of the State, and Mayor Doyle, of Providence, regretting their inability to be present. A letter from Mr. Stephen D. Field was also read, in which he sent his regards to all the "boys," and his regrets at not being able to meet them—for reasons best known to his friend, Mr. John Sabin. The address of welcome was made for the American Electrical Works by Mr. Ralph Pope, who is an old resident of Providence, and then the feast began. It was admirably served, and was most heartily enjoyed by every one to the accompaniment of

unlimited conversation and fun. About 5 P. M. the return to Providence was made after one of the pleasantest days ever spent along the shores of Rhode Island. Great credit is due to the proprietors of the works and their representatives, not only for the liberality that prompts them to bring the electrical fraternity together as a whole once a year, but for the thorough hospitality with which the entertainment is carried out. Only Rhode Island and the American Electrical Works can get up such a clambake as that of Sept. 11, 1885.

The Growth of Electric Lighting.

Few facts exemplify so well the advance of electric lighting in this country as the growth of the Thomson-Houston Company's business. Subjoined is a list of the plants newly installed or increased since January 1, 1885 :

St. Louis Thomson-Houston Electrical Company	135 increase
Excelsior Electrical Company, Port Huron, Mich	101 new
Carew Manufacturing Company, South Hadley, Mass.	10 "
Windsor Locks Steel Company, Windsor Locks, Conn.	10 "
Thomson-Houston Electric Light Company, Philadelphia	465 increase
Atchison Electric Light and Power Company, Atchison, Kan.	30 "
Syracuse Electric Light and Power Company, Syracuse, N. Y.	30 "
Georgia Electrical Light Company, Atlanta, Ga.	45 new
Champion Electric Light Company, Springfield, O.	30 increase
Worcester Electric Light Company, Worcester, Mass.	40 "
W. A. Foote, Adrian, Mich.	60 new
Leavenworth Coal Company, Leavenworth, Kan.	50 increase
Jacksonville Electric Light Company, Jacksonville, Ill.	30 new
J. C. Regan, Omaha, Neb.	120 "
Thomson-Houston Electrical Company, Rockaway Beach, L. I.	45 "
Thomson-Houston Electric Light Company, Long Branch, N. J.	90 "
M. Shall, York, Pa.	90 increase
Terre Haute Electrical Light and Power Company, Terre Haute, Ind.	110 new
North Adams Electrical Light and Power Company, North Adams, Mass.	38 "
Norwich Electrical Light Company, Norwich, Conn.	76 "
Springfield Electrical Light Company, Springfield, Conn.	136 "
Electrical Lighting Company, Mobile, Ala.	50 "
Newport Illuminating Company, Newport, R. I.	113 "
Bangor Electrical Light and Power Company, Bangor, Me.	114 "
Thomson-Houston Electrical Light Company, Asbury Park, N. J.	45 "
Poughkeepsie Electrical Light and Power Company, Poughkeepsie, N. Y.	76 "
Thomson-Houston Electrical Light Company, Plainfield, N. J.	45 "
Merchants' Electric Light and Power Company, Boston, Mass.	90 increase
Columbus Electric Light and Power Company, Columbus, O.	25 "
Cleveland Electric Light Company, Cleveland, O.	180 new
New Haven Electric Company, New Haven, Conn.	45 increase
Hartford Electric Light Company, Hartford, Conn.	125 "
Pawtucket Electric Light Company, Pawtucket, R. I.	45 "
Connecticut District Telegraph and Electric Company, Waterbury, Conn.	45 "
Lewiston & Auburn Electric Light Company, Auburn, Me.	38 "
Consolidated Electric Light Company, Portland, Me.	55 "
Citizens' Electric Illuminating Company, Brooklyn, N. Y.	180 "
Municipal Electric Light Company, Brooklyn, N. Y.	135 "
C. E. Rector, Chicago, Ill.	12 new
Badger Electric Company, Keokuk, Iowa	60 "
W. D. Black, New Milford, Conn.	38 "
V. Q. Irwin, Crawfordsville, Ind.	42 "
Montana Mining Company, Marysville, Mont.	6 new
Salem Electric Light Company, Salem, Mass.	30 increase
United States Electric Company, Washington, D. C.	90 new
Lansburgh & Bro., Washington, D. C.	20 "
Woodworth & Lothrop, Washington, D. C.	10 "
National Hotel, Washington, D. C.	10 "
Steere Worsted Mill, Providence, R. I.	38 increase
Wm. Tinkham & Co., Harrisville, R. I.	40 new
Bethlehem Electric Light Company, Bethlehem, Pa.	76 increase
Freeport Gas, Light and Coke Company, Freeport, Ill.	60 new
Pontiac Electric Light Company, Pontiac	25 "
Pliny Norcross, Janesville, Wis.	60 "
Brookline Electric Light Company, Brookline, Mass.	90 "
Narragansett Electric Light Company, Providence, R. I.	295 increase
Aqueduct, New York	95 new
Oshkosh Electric Light and Power Company, Oshkosh, Wis.	60 "
Thomson-Houston Electric Light Company, Elmira, N. Y.	45 increase
J. P. Dieter, Portsmouth, O.	45 new

The Fight Against the Bell Patents.

We give below the affidavit of Mr. Wilber, formerly examiner in the United States Patent Office, upon which the National Improved Telephone Company is chiefly basing its proceedings against the Bell Company, as mentioned by us last week :

[COPY.]

City of Washington, } ss.
District of Columbia, }

Zenas Fisk Wilber being duly sworn deposes and says:

I reside in the City of Washington, in the District of Columbia, am 43 years of age, and am by occupation a solicitor of patents.

In the year 1876 I was employed by the Government of the United States as Principal Examiner of the Patent Office, in charge of the class of electricity. The application of Alexander Graham Bell for a patent for improvements in telegraphy, which was filed Feb. 14, 1876, which patent was issued on the 7th day of March, 1876, and numbered 174,465, was put in my charge as Examiner, and was passed to issue by me.

I reached the said application for examination on Feb. 19, 1876, and found on that day that a caveat had been filed by one Elisha Gray on Feb. 14, 1876, for a new art of transmitting vocal sounds telegraphically, which caveat, in my opinion, interfered with the first, fourth and fifth claims of Bell's said application.

On said Feb. 19, 1876, I notified Messrs. Pollock & Bailey, Bell's attorneys, that the first, fourth and fifth clauses of claims in said application relate to matters described in a pending caveat. Afterward, to-wit, on or about Feb. 24, 1876, the said attorneys, Pollock & Bailey, addressed a letter to the Commissioner of Patents wherein they stated that they had "inquired the date of filing of the caveat, inasmuch as we are entitled to the knowledge," and protested against the delay which the notice to the caveator would subject them to. They thereupon made a special application to the Commissioner of Patents, under whose instructions I afterward, to-wit, on Feb. 25, 1876, withdrew the suspension of the application.

I have since carefully examined the law on patents, and am satisfied that the notice to the attorneys of Bell of Feb. 19, 1876, is not warranted by law, and that their ascertainment of the date of filing Gray's caveat is also contrary to the letter and spirit of section 4,902 of the Revised Statutes.

To give such information to applicants for patents had to an extent become a custom in the Patent Office, but I now clearly perceive that the law did not contemplate the giving of such information to an applicant for a patent, as it distinctly requires the caveat to be kept secret, and the caveator alone to be notified

On the 29th day of February, 1876, an amendment was filed by said attorneys for Bell and incorporated in the application, but to said amendment Bell did not make oath, nor did he subscribe to the same, as I verily believe.

Sworn and subscribed to before me this 30th day of July, A. D. 1885.

ZENAS FISK WILBER.

Sworn and subscribed to before me this 30th day of July, A. D. 1885.

JOHN E. BEALL,
Notary Public.

SEAL.

Western Union Earnings.

Various are the speculations as to the earnings of the Western Union Company. The well-known firm of F. M. Lockwood & Co. declare that, from the statements, the Western Union Telegraph Company is not earning its dividends, if any money is spent for construction. The estimated revenue, etc., for the quarter ended Sept. 30 was given last week. Comparison with the same quarter of 1884 follows :

	1885.	1884.	Changes.
Net revenue	$1,450,000	$1,750,000	Dec. $300,000
Interest and sinking fund	143,768	104,000	Inc. 39,768
Balance	$1,306,232	$1,646,000	Dec. $339,768
Dividend, 1½ per cent.	1,199,842	*1,399,810	Dec. 199,968
Balance	$106,390	$246,190	Dec. $139,800
Surplus, July 1	4,324,004	4,157,468	Inc. 166,536
Total surplus, Oct. 1	$4,430,393	$4,403,658	Inc. $26,735

*1¾ per cent.

Electricity in the Broadway Underground Railway.

It is said, upon what is considered good authority, that the Broadway underground railway scheme, regarding which so much has lately been said by the press of this city, is assuming such business-like shape as to insure the building of the road. The enterprise is one of enormous magnitude, and the six and one-half miles now under contract from the Battery to Harlem, and its branches, will cost, according to surveys and estimates, made and carefully supervised by Gen. Geo. B. McClellan, from $1,200,000 to $1,400,000 per mile. The *American Contract Journal* says that a contract has been let for building the road. Many leading capitalists and business men of New York are interested in the enterprise. The entire structure will be continually lighted by electricity, and the trains run by electric motors. The road when built will solve the underground wire problem in New York. Arrangements have already been made with the American Electric Manufacturing Company by which the American Company will control the lighting of the great structure, supply the electric motors, as well as for the control of the right for placing telegraph, electric light, telephone, fire alarm and other wires in the structure.

The Electric Tramways in Antwerp, Belgium.

To the Editor of the Electrical World :

SIR : You mention in your issue of the 15th August that an electric tramway, operated by a Siemens plant, conveys visitors from the railway station to the exhibition buildings at Antwerp.

There is in effect an electric tram-car in operation as a competitor with the mechanical tractors now offered at the Antwerp exhibition.

This carriage has been running every day for three months, 11 hours daily, between the station and the exhibition. The line is two miles long, and the total length run a day is sixty miles. The number of passengers carried each journey is about 45—600 a day. The speed is six to seven miles an hour. This car was designed and built by the "Société Anonyme, L'Electrique," at Brussels. The electricity is applied to the propulsion by means of a battery of accumulators, patent of which is held by the company. Current is supplied from the battery to an electro-motor, whence the motive power is transmitted to the axle of one pair of wheels.

This electric tram-car is indeed a very great success ; it is *le clou* of the exhibition.

Contracts are to be signed to apply this new system to the traction of twenty cars on the most important line of Brussels, four miles and a half length.

ALFRED ALLARD, Secretary Soc. Anon. L'Electrique.
BRUSSELS, Sept. 4.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Sept. 17, 1885.

The Thomson-Houston Electric Company has recently filled an order for ninety arc-lights, to be immediately installed in Washington, D. C. It has also put in forty-five arc-lights at Portsmouth, O. This is simply the advance trumpeter to a large order soon to follow.

The Ball Electric Light Company, through its New England agency, is at present engaged at installing a ninety arc-light plant in the Providence Worsted Mills, Providence, R. I. Mr. H. M. French of the same company, has just closed a contract with the Philadelphia Cyclorama for a plant of forty arc-lights.

Messrs. Blodgett Bros. & Co., general electricians, are making the apparatus for the Pidgin Electric Calculating Company. All the parts of this ingenious machine were designed for the inventor by the above-named electricians.

The mechanical call-box, now being manufactured by the Electric Development & Manufacturing Company, of this city, contains several new and interesting features. This box has only 51 parts, while the old-style boxes have 83. It works in a remarkably easy manner, and it is next to an impossibility for it to get out of order. One of the principal features which commend this call-box to the public is that it is so constructed that it cannot leave the circuit open. Without the addition of other parts, it may be also used, when desired, as a multiple box.

The Vandepoele Electric Railway has been put in operation in Toronto, to carry visitors from the terminus of the horse-car line to the Fair grounds, a distance of about a mile. Trips are made in 2½ minutes. Large numbers of people are carried over the road daily. Several prominent electricians from the United States are at present in Toronto, with a view of examining this electric railway.

The fifty-seventh annual exhibition of the Massachusetts Horticultural Society opened on Tuesday last in the Horticultural Hall, this city. The halls and corridors were lighted by electric light of the American system, which brings out the colors and forms of flowers and plants more vividly than even sunlight.

The plant of 40 arc lights installed at Crescent Beach, near this city, a few months ago by the Remington Electric Light Company, and which was put in on lease with option of purchase by the Revere Beach Land Company, has given entire satisfaction, and has been purchased and paid for.

The electric light plant at New Bedford, Mass., using the Thomson-Houston system, is to be enlarged and the number of lights increased. The promoters of the enterprise are putting in two more boilers set with the Jarvis patent furnace.

The New England Electric Manufacturing Company, No. 21 Hamilton street, are making the wonderful and ingenious Electric Polargraph Machine, which was briefly referred to recently in these columns. Electricians who have examined this novel apparatus pronounce it a combination of scientific mechanism and artistic workmanship, and predict that every steamship or sailing vessel plying the waters adjacent to dangerous coasts will gladly become possessors of same at any price.

At the new electric light station at Milford, Mass., there will be 45 Thomson-Houston arc-lights and 300 Brush-Swan incandescent lights. The plant will be fitted with a 60 h. p. Armington & Sims engine and a 60 h. p. boiler, set with the Jarvis furnace. The installation of this plant will be in charge of the Jarvis Engineering Company.

Rumor has it that a new electric light company will soon be organized in New England. As yet, no definite arrangements have been effected as to location of factory, but it is intimated that the general offices will be established in this city.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, Sept. 16, 1885.

The Parker-Russell people have certainly made excellent progress in the manufacture and introduction of carbons for electric lighting use. In my letter from St. Louis, mention was made of the fact that they were finding it necessary to increase their capacity, which is now half a million a month, and add to their works. They would appear to have the manufacturing problem involved pretty well worked out. One reason, perhaps, for the favorable reception which their carbons have received, is to be found in the fact that they have running at their factory dynamo machines of all the principal makers, which enables them to better adapt their carbons to the different systems. Their works are extensive and are located about five miles out from the centre of the city, at Oak Hill. They are about to bring out a cored carbon which they expect will be very superior.

By a late arrangement with the Conduit Company, the territory south of Twelth street, Chicago, is put in the same relation to the electric light companies as were the other portions of the city by the arrangement mentioned in this column June 17.

Madison, Wis., is to have an American District Telegraph system.

Louisville, Ky., I found on the occasion of my recent visit there, has burning nightly within its limits about 110 United States arc lights and about 35 Brush ; there are also about 350 United States incandescent. In winter they use a somewhat greater number of lights than this, and the combined capacity of the Brush and United States arc machines is 300 lights. The above figures are exclusive of the lights used by the Exposition people, which, as has been mentioned in this column before, are Fort Wayne-Jenney arc and Stanley incandescent. The President of the Louisville Electric Light Company (using the United States apparatus) is Mr. C. H. Connor, and of the Brush Company, Mr. J. L. Smyser.

Louisville does not make a very good showing of electric lights as regards numbers. There would seem to be an opportunity here for the placing of a large number of additional lights. Certainly Louisville does not compare favorably in this respect with other Western cities of about the same population.

The American Carbon Company, of St. Louis, is about

to put on the market a molded carbon specially adapted for use with the Thomson-Houston, Brush and Excelsior systems.

It is rumored that the electric light plant in the government buildings here in Chicago is to be put in operation again. This plant was shut down some time ago, and the use of gas resumed. The reason given for this action was that lighting by electricity was found to be too expensive. The matter has since been investigated by the Washington officials, if the newspapers are to be believed, and it has been found that the government is saving money by the use of electricity in lighting the public buildings in St. Louis and other cities, and no good reason can be put forward that should make Chicago an exception in this respect. The government owns the plant, and cannot understand why, this being the case, lighting by electricity should be more expensive than gas here, when in other places it is found more economical. Besides the use of gas made the offices uncomfortably warm during the hot weather, the change from electricity being very noticeable. It is probable that a few days will see the plant running again. At any rate it is to be hoped that this will be the case.

Mr. Glover, of Detroit, who has the contract for wiring the Indiana State House for electric light, is now at work with a large force of men, pushing the work forward as fast as possible.

The Woolley Locomotive Electric Headlight Company have completed their factory in Indianapolis, and are now busy making tools and getting matter in shape for business.

I notice that the suggestion of THE ELECTRICAL WORLD made some time before the convention, that Western men be allowed the more important officer of the National Telephone Exchange Association for the ensuing year has been acted upon, the West receiving both the presidency and vice-presidency, and in addition the place of the next meeting. This suits us very well out this way, and THE WORLD has created a very favorable impression among telephone men here by the force with which it stated the case prior to the action of the convention indorsing its views.

Among the late sales of the Western agency of the United States Electric Lighting Company are a 60-light arc plant at Moberly, Mo., a 20-light arc plant at Eureka, Kan., and a 20-light arc plant to the Southern Hotel, Chicago. Also two incandescent plants, one in St. Louis and one in Chicago, aggregating 450 lights.

Telephone stock quotations according to the report of S. G. Lynch, 144 La Salle street, Chicago, are as follows:

Central Union	54@56	Great Southern	50@ 55
Michigan	68@70	Rocky Mountain Bell	50@ 55
Iowa Union	20@23	Chicago	375@400

THE TELEGRAPH.

Underground Work at Lowell, Mass.—The Woodward Underground Telegraph and Telephone Company is seeking for permission to put down its system in Lowell streets.

Kansas.—The Baltimore & Ohio Telegraph Company has been successful in having an injunction dissolved which had been procured by the Western Union monopoly, to prevent the extension of the opposition lines in Kansas.

Buying More Lines.—Mr. E. S. Stokes has bought for $65,350 the Ohio lines of the Bankers & Merchants' Company. The lines are, however, still subject to litigation as being, it is claimed, the property of the American Rapid Company.

Cable Rates Abroad.—A dispatch of Sept. 14 from London says that the majority of the cable companies have reduced their rates. The details are unknown yet. The rate from England to Australia will be 8s. 8d. per word for ordinary and 2s. 8d. for press messages, and to Bombay and Madras 7s. 6d. and perhaps 5s. 3d.

Western Lines.—The lines sold at Cleveland to Mr. E. S. Stokes run from Pittsburgh to Columbus and thence to Indianapolis and Cincinnati, in all 752 miles of poles and wires, of which 400 miles are provided with 10 wires. It also embraces connecting lines consisting of 503 miles of poles with 2,012 miles of wires, running to Detroit and Toledo, thence all through Indiana and Michigan, and connecting at Chicago with the underground system. The lines will all be turned over to the United Lines Company and will form one of the most important sections of our system.

The Fight in the South.—The Western Union Telegraph Company applied to the courts at Little Rock, Ark., last week, for an injunction to prevent the Arkansas Telegraph Company from building a telegraph line along the right of way of the Little Rock, Mississippi River & Texas Railway, between Pine Bluff and Little Rock, claiming an exclusive contract with the railroad company. The injunction has just been denied, because at the last session of the Arkansas Legislature a telegraph law was passed similar to that in effect in nearly every other State in the Union, granting telegraph companies rights of way on all railroads in the State of Arkansas. The Arkansas Telegraph Company is a branch or extension of the Baltimore & Ohio system to Little Rock, Hot Springs and other important places in this State. Material is on the ground and work will now be pushed forward rapidly. Little Rock will probably be connected with the Baltimore & Ohio system by Sept. 20; Hot Springs soon thereafter. Arrangements have also been made for an extension to Memphis, Tenn.

THE TELEPHONE.

A Sad Death.—Washington Court House, O., was visited by a serious cyclone last week, by which the place was wrecked, and many persons killed or injured. Among the killed was Mr. Herbert Haggart, the local telephone operator, who was greatly regretted.

Paducah, Ky.—Mr. N. F. Harmon, who has been in the telephone business for about 6½ years, has been appointed Manager of the Paducah Exchange of the East Tennessee Telephone Company. It has 86 subscribers and promises a rapid increase. Mr. Harmon has worked hard in the electrical field and has "won his spurs."

Mexico.—The Mexican company has contracted with the Mexican Government for a 40-mile suburban line, the government to pay for construction, except for instruments, to pay $250 per month rental and $100 per year for repairs. The company is earning $3,200 per month, against $2,200 a year ago, and is fast absorbing the subcompanies. The fourth will soon pass under its control.

The Telephone in Russia.—According to the rules under which the telephone companies are formed in Russia, 10 per cent. on private subscriptions and 5 per cent. on those of municipal and government corporations are paid over to the treasury; 5,000 roubles in the capitals and 2,000 roubles in provincial towns being the minimum. In 1883 the revenue derived from this source exceeded 22,000 roubles, in 1884 it was about 25,000 roubles, while that for the present year is expected to reach 40,000 roubles.

Arrest of a Telephone Superintendent.—M. C. Quinn, superintendent of the Echo Telephone Company, was arrested and locked up on the 9th inst., at Paterson, N. J. The complainants were creditors of the Echo Telephone Company, who allege that the company is merely a name, but that the whole thing is a scheme for swindling. Mr. Quinn insists that it is a regularly organized company, with headquarters in New York. Wires have been put up through Paterson and almost to New York. None of the supplies have been paid for, and there is about $700 due the employés for wages.

The Newark Suits.—President Charles F. Cutler of the New York & New Jersey Telephone Company desires to have the following published, to correct an erroneous report by wire, the case referred to being of considerable local interest: "The Domestic Telephone Company filed a bond for $25,000 in the Court of Chancery, Aug. 31, to secure the New York & New Jersey Telegraph and Telephone Company from loss pending an injunction which restrains the latter from interfering with the rights of the Domestic Company, until the Chancellor shall have decided the suit between the two companies for the possession of the Newark company's property. The case was recently decided against the Newark company, and the decision was sustained by the Court of Errors, but a new trial was granted on an amended bill."

News from the Seat of War.—In speaking of the advance in telephone rates in New England, the Lowell *Courier* says: The company is apparently hurting itself by this course. In Salem all the physicians and scores of business men have "bounced" the machines; in Peabody the system has been practically ruined; in Augusta and Gardiner, Maine, over half have been taken out; in Housatonic every one of the telephones was ordered out, and in every other place a similar state of things prevails. It certainly seems foolish for the company to thus enrage its patrons who have been paying it good solid money in liberal sums. One subscriber says, It is all the American Bell's fault, in charging $14 a year for the use of instruments which don't cost half that amount, but he philosophically reasons that it is human nature to get as much as possible out of an invention. Future developments of the feeling among local subscribers are likely to be interesting.

THE ELECTRIC LIGHT.

Framingham, Mass.—The Jarvis Engineering Company, Boston, Mass., has recently sold an Armington & Sims engine to the Para Rubber Company, Framingham, Mass., to run 600 Brush-Swan incandescent lamps.

Quick Work.—The Fitchburg Steam Engine Company recently received an order from the Grinnell Manufacturing Company, of New Bedford, Mass., for a 150 horsepower engine to run their electric light plant of incandescent lights, and in 20 days from the receipt of order the engine was shipped, there having been no portion of the engine in the works when the order was placed. This is a good example of the prompt execution of work.

Photographing Gun Interiors.—At Woolwich, England, a week or two ago, experiments were made with the object of testing the feasibility of photographing the interior of guns by means of the electric light, so as to detect any flaws. The subjects of the test were two 8-inch muzzle-loading guns. The light was introduced a few inches within the muzzle, and reflected by way of a mirror down the bore, the photograph being taken at the breech end. The experiment was fairly satisfactory:

The Electric Light in Portugal.—Although the electric light is making its way steadily in every other European country, Portugal obstinately refuses to avail herself of one of the greatest blessings of modern civilization. Her cafés, her hotels, and promenades are dim with bad gas, and redolent of the odors which invariably attend the injudicious use of that source of semi-darkness. In that little kingdom there is but one lamp (a Siemens arc), and one dynamo. These are installed in the ancient Tower of Belem, on the Tagus, and serve not only to light up the entrance to the river, but to enable a sharp watch to be kept upon the vessels in quarantine, and the Lazaretto upon the left bank. Electricity against disease.

Canadian Enterprise.—The Halifax (N. S.) Electric Light Company has secured the contract from the city for lighting the streets by electricity. Notwithstanding the powerful influence brought to bear against the Council by the gas company, 39 arc lights (of the *Thomson-Houston* system) are now being placed in position on the streets, and it is expected that this number will be increased later. The Halifax Electric Light Company is one of the numerous offspring of the Royal Electric Company, Montreal, and has an exceedingly well-equipped plant of 100 arc light capacity and 10 miles of circuit. Besides the contract for street lighting, it has a large number of private lights, all under an efficient electrician, Mr. A. T. Smith. The directors and managers deserve great credit for their enterprise and push, especially when it is considered that it is only *one year* since the inception of the project in a city hitherto notorious for being considered "slow."

War Vessels and the Electric Light.—In the opinion of the *St. James' Gazette* it cannot be said that the practical experience of the electric light, as fitted to war ships, has been wholly satisfactory. It brightly illuminates everything upon which it is flashed, but it greatly intensifies the apparent darkness on both sides of the actual beam. Seamen, too, who are using the light become "night blind." Ordinarily their night sight is very good. They can at sea readily distinguish objects which to a landsman's gaze are invisible, but when electric lights have been flashing around them for a few minutes, this valuable gift temporarily deserts them. *St. James'* therefore suggests, as a minor naval need, that electric lights should be placed on outlying boats, and controlled by cables from shore, or from warships. In warlike operations an ironclad would be at a great advantage if, while herself remaining in darkness, she could direct a beam whereby an opposing ship would be brilliantly shown up.

Espying Distant Bodies.—The German War Department has been experimenting upon the illuminating power of the electric light on distant bodies. In these investigations the distance of the arc lamp or other source of light from the object, as also the distance of the observer, entered into the calculations; in other words, the total distance traveled by the rays of light from the lamp to the illuminated object, and thence by reflection to the eye of the experimenter, was taken into account. Is was ascertained that with a distance of 8,000 metres between the object and the lamp, the former could be detected at a length of 50 metres from the point of observation; with the object and the lamp 6,000 metres apart the object could be seen by the observer at 600 metres distance; with 1,500 metres only interposed between source of light and the object, the greatest distance at which it was visible was 4,300 metres. With a more powerful lamp the results were similar, the maximum distance traveled by the rays being 10,500 metres, 4,500 of which constituted the path of reflected light, or the distance between observer and object, and 6,000 the path of the direct rays between the object and the lamp.

APPLICATIONS OF POWER.

New Orleans.—Bids are invited by the board of managers for an electrical railway on the Exposition grounds at New Orleans, the coming season.

New York Elevated.—The Daft motor, "Benjamin Franklin," has made successful runs on the Ninth Avenue road with a four-car train this week,

MISCELLANEOUS NOTES.

A New Professorship.—The Council of University College, London, has created a professorship of electrical engineering.

Mr. J. L. Barclay, formerly of the Stout-Meadowcroft Company, is now outside salesman for Messrs. Holmes, Booth & Haydens, who have secured in him a very pleasant and efficient representative.

Galvanic Action on Hulls.—A discovery having an intimate bearing upon certain harbor erections has been made by Mr. Thomas Andrews during a course or experimental research. He has found that the galvanic destructive action in parts even of the same metal, arising from difference of electrical potential while diffusion is going on between the surface and the lower water in the tidal stream, is, on comparison with the results of other investigations conducted by him, apparently of much greater extent than the loss either from simple erosion in sea water alone, or than that which ensues from the action of each other of dissimilar metals of this group—such as wrought irons, cast metals and steels—in galvanic connection in sea water. It evidently follows from this also that an iron steamship while in a tidal port sustains more deterioration in her hull exposed to the simultaneous action of the top or fresh water and the bottom or sea water than she does, other things, of course, being equal, from the action of water in open ocean.

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—Am. Dist., b 17, a 22; B. & M., b 1, a 1½; Western Union, b 70¾, a 70⅞.

Telephone.—Am. Bell, b 191, a 192; Erie, b 27, a 27½; New England, b 28½, a 29¼.

The return of instruments consequent upon the advance in telephone charges, which went into effect in part this week, is less than might have been expected. There is this compensation as regards the revenue: The instruments remaining will pay better than before, perchance offsetting the reduction of the number in use. Nothing has been done yet regarding the much mooted New England dividend in October.

Electric Light.—Edison, b 50, a 60.

BUSINESS NOTICES.

Anti-Magnetic Shields for Watches.—These shields, made by Giles, Brother & Co., State and Washington streets, Chicago, are an efficient protection to the works of watches from magnetism, as many testimonials in their possession show. This firm also demagnetize watches that are already affected. The Eastern Agent is W. A. Wales, 16 Maiden Lane, New York.

Activity in Boston.—Business is reported very brisk by Messrs. Fuller & Holtzer, of Boston. They have just executed a contract for wiring the extension of the Parker House in Boston for 250 incandescent lamps, and their system of wiring this work has been judged the best job of the kind ever done in that city. The watchman's registers of this firm are fast acquiring a deserved reputation. A large one was lately placed in the city hospital building of Boston, and their sales to the trade have been increased. The new Holtzer cylinder battery, introduced by this firm, has been taken up very favorably throughout electrical circles, and the amount of power obtained by this battery has caused much surprise. Its great simplicity, strength and convenience will, it is claimed, soon make it the standard article for telephones, electric signals, etc. The Hotel Kensington, Hotel Nightingale and other leading family hotels have been fully equipped in the best manner by the firm with their leading electrical specialties. The house now employs double the usual number of hands, and has room for additional experienced help.

Pike's Toothache Drops

Cure in 1 minute; harmless, quick, thorough; no equal; 25c.

DEAN'S RHEUMATIC PILLS are a prompt, sure cure; 50c.

HALE'S HONEY, the great cough cure, 25c., 50c. and $1.

GLENN'S SULPHUR SOAP heals and beautifies the skin; 25c.

GERMAN CORN REMOVER kills corns and bunions; 25c.

HILL'S HAIR AND WHISKER DYE, black and brown; 50c.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED JULY 7, 1885.

Galvanic Battery; Charles P. Orne, Cambridge, Mass.... 321,446

On top of the packing of lumps of gas-retort carbon, and surrounding the porous cup and extending from it throughout the annular space between it and the upper part of the vessel, is a layer of paraffine-wax, through which holes are made from its top to its bottom.

Electric Light System; Elihu Thomson, Lynn, Mass., Assignor to the Thomson-Houston Electric Light Co., Connecticut..... 321,461

Consists in placing a coil in one or more of the branches of the main circuit conveying a continuous electric current, which coil has a high self-induction, a large coil of copper wire wound around a mass of iron being sufficient. The resistance of the coil is made low, so as to avoid waste of energy. It is only necessary that it be constructed of sufficient proportion to exert a powerful tendency to reactive or extra-current effects.

Electric Switch; Elihu Thomson, Lynn, Mass., Assignor to the Thomson-Houston E'ectric Co., Connecticut..... 321,463

The object is to provide a simple and effective means for extinguishing incandescent electric lamps or for varying their intensity. A solenoid is adapted to be thrown into series or shunt to the lamp, and movements of its core regulate the intensity of the light.

Lightning Arrester; Elihu Thomson, Lynn, Mass. 321,464

Consists of an arc-rupturing device, applied so as to rupture any arc that may form across the space between the plates or electrodes.

Incandescent Lamp Holder; Alfred Haid, Rahway, N. J., Assignor to the Excelsior Electric Apparatus Co., New York, N. Y..... 321,493

Consists of metal strips, secured in one section, and springs secured to an insulating-plug and connected with the battery wires, and fitting loosely within the other section, these parts being so constructed that the springs when joined to the strips are held in contact therewith by uniting the two sections of the holder.

Spring Jack Switch; James C. Warner, Chicago, Ill., Assignor to the Western Electric Co., of same place..... 321,553

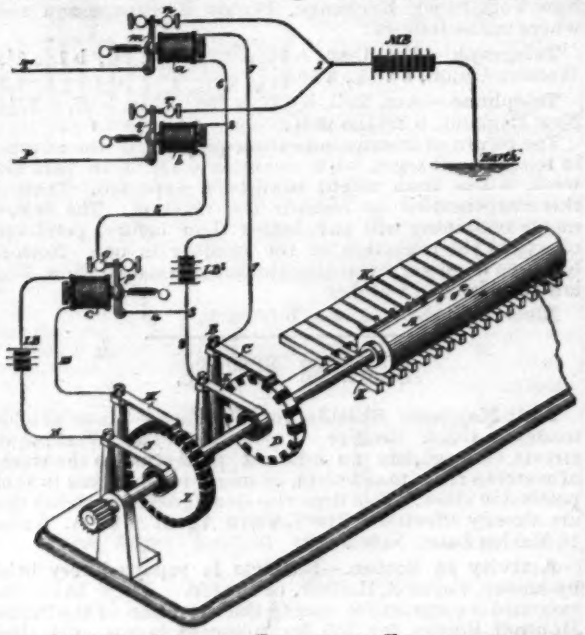
Consists in a spring jack provided with a lug or collar, and a forwardly projecting sleeve adapted to be inserted through the switch-board from the rear of said board and to receive the connecting-plugs from the front of said board; second, in the combination, with the spring, the contact-point and the frame of a spring-jack switch, of a tapered or conical insulator for said contact-point.

Dynamo; Edward Jones, Leeds, England..... 321,609

Consists of two or more channeled pole-pieces, each having a separately-wound core or shank secured to the said single end plate, and arranged parallel to the armature spindle, and a commutator mounted on the said spindle in close proximity to the armature, and at that side thereof which is remote from the single end plate or standard of the machine.

Insulator; Edward T. Schoonmaker, New York, N. Y., Assignor of one-half to John E. Smith, of same place..... 321,646

Consists of the shield having in its interior a groove in



321,858. PRINTING TELEGRAPH TRANSMITTER.

the form of a female screw thread and the shank having a series of spurs arranged at distances apart thereon, on different sides thereof, and in spiral relation to each other to form portions of a male screw thread corresponding with the groove or female thread in the shield.

Regulator for Electric Lights; Walter J. Paine and Sidney B. Paine, Boston, Mass..... 321,748

Consists of a regulating switch having moving and stationary contacts, constructed and connected to throw the lamps into arrangements in series, and a resistance and contacts for throwing such resistance into connection with the groups successively.

Regulating Electric Lights; Walter J. Paine and Sidney B. Paine, Boston, Mass..... 321,749

Consists in throwing groups of lamps into and out of circuit successively, and varying the candle-power of the lamps of each group in succession, by throwing them into and out of series with other lamps and into and out of connection with external resistance.

Secondary Battery; John S. Sellon, Hatton Garden, England..... 321,759

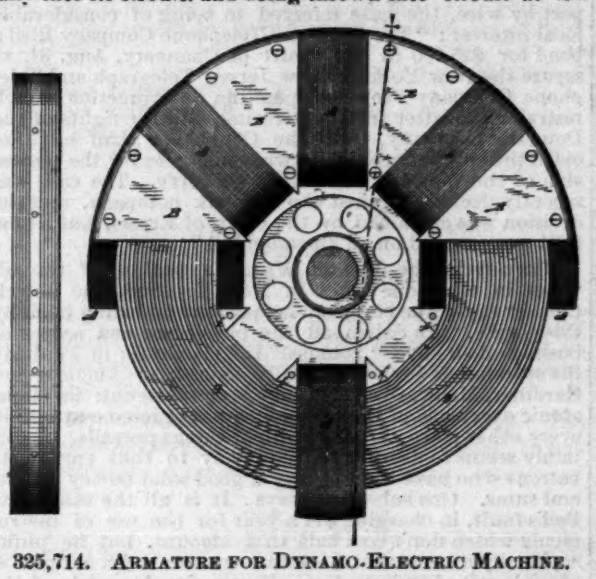
Comprises interposed distance-plates formed of strips of wood or similar stiff non-conducting material connected by threads to form a matting.

Regulator for Electric Lights; Walter J. Paine, Boston, Mass., Assignor of one-half to Sidney B. Paine, of same place..... 321,843

The object is to do away with the bulky and expensive resistance-boxes heretofore used for lowering and raising the candle-power of incandescing electric lamps. The lamps themselves are used as resistances for reducing the candle-power by throwing them into a proper series relation.

Regulating Electric Lights; Walter J. Paine, Boston, Mass., Assignor of one-half to Sidney B. Paine, of same place..... 321,845

He arranges the lamps in groups, the lamps of each group being in the same circuit, and the lamps of the several groups being properly intermingled or located, and throwing these groups into and out of circuit successively, each group before being thrown out of circuit being reduced in candle-power by introducing resistance gradually into its circuit, and being thrown into circuit at low



325,714. ARMATURE FOR DYNAMO-ELECTRIC MACHINE.

candle-power by the use of resistance, which is gradually reduced to raise the group to full candle-power.

Regulating Electric Lights; Walter J. Paine, Boston, Mass., Assignors of one-half to Sidney B. Paine, of same place..... 321,846

Consists in changing the relation of the groups of lamps from multiple arc to series.

Printing Telegraph Transmitter; George B. Scott, Brooklyn, Assignor to the Western Union Telegraph Co., New York, N. Y..... 321,858

The device is shown in the cut, and consists of two main lines, a circuit breaker for the type-wheel circuit, a circuit-breaking wheel having as many narrow conducting-spaces as there are characters on the type-wheel, and a series of key-stops.

Underground Electric Wires; John Teggart, San Francisco, Cal..... 321,865

Consists of standards provided with one or more transverse openings and one or more transverse arms passing through such opening or openings, each provided with a notch adapted to receive and embrace a portion of the standard, and near its ends with notches to receive and hold the wires.

Primary or Galvanic Battery; Eli T. Starr, Philadelphia, Pa., Assignor to the S. S. White Dental Manufacturing Company, of same place.. 321,917

Consists of a porous cup having portions thereof porous and other portions non-porous, and provided with projections, shoulders or ledges to prevent contact between said porous portions of said cup and the battery plates or elements facing said porous portions of the cup.

Holder for Incandescent Lamp; Henri Pieper, Liege, Belgium..... 321,933

Consists of two main parts, viz., a fixed insulating plug and a spiral of strong wire, forming a kind of nut, adapted to be screwed with one end on the said plug and to be attached with its other end to the base of the lamp, in combination with the requisite electric connections and with a contract-breaker formed by a shoulder on the spiral and a knob or binding-post on the plug, the said shoulder being arranged to be brought into or out of contact with the knob or post by turning the spiral on the plug.

Conveying Persons by Electromotive Force; Ernst W. Siemens, Berlin, Germany..... 321,934

Consists of an electro-dynamic motor having a revolving armature suspended beneath the floor of the car and a yielding mechanical connection between the revolving armature and the driving wheels.

PATENTS DATED SEPTE BER 8, 1885.

Electric Switch Plug; Jesse H. Bunnell, Brooklyn, N. Y..... 325,653

He provides the insulating-handle of the plug with a projection, which projection is provided with grooves or channels for receiving the ends of the wires, and with a flexible sleeve of rubber, which fits over the grooved projection and the ends of the flexible conductor, and thus serves to protect the same from accident or injury.

Telephone System; Amos E. Dolbear, Boston, Mass..... 325,659

Comprises a transmitter in one primary circuit of an inductorium, a circuit-breaker in the other primary circuit of a second inductorium, and signal instruments and receivers in the line formed by the secondaries of the inductoriums.

Telephone System; Amos E. Dolbear, Boston, Mass..... 325,660

Comprises a receiver-plate coated with a dielectric, an inductorium whose primary contains a circuit-breaker adapted, when in operation, to induce a high electromotive force in the secondary circuit, and thereby charge the dielectric coating of the plate.

Printing Telegraph; Robert J. Sheehy, New York, N. Y..... 325,702

The details are shown in the cut. The invention consists of a longitudinally-movable carriage, upon which the paper which is to receive the impressions, is placed at the back of the instrument. In front of the same is placed an annular series of type or a type-cylinder, which are successively brought, by the rotations of a supporting-shaft, into position to have their characters imprinted upon the paper. This shaft, and thus the type-cylinder, is revolved by means of an electro-magnetic motor before the paper thus presented.

Armature for Dynamo-Electric Machine; Sylvanus F. Van Choate, New York, N. Y..... 325,714

Consists, as shown in the cut, of the spine *C*, spinal coils of wire *G*, and non-magnetic plates *B*; coils *A*.

Lighting Railway Cars; Harry E. Freese, Philadelphia, Pa..... 325,795

Each car is provided with a furnace, a fuel-reservoir connected with said furnace, a steam-engine, an electric circuit, including a dynamo-electric generator which is geared to the engine, and a case which incloses the furnace, engine, fuel-reservoir and the generator, and prevents the heat from radiating in the car.

Arc Lamp; George M. Hopkins, Brooklyn, N. Y. 325,802

Consists in an electro-magnet having cores extended beyond its coils and slotted to receive the carbon supporting rod, and in an armature pivoted at one end to a spring supporting it within the field of the magnet and provided with an arm reaching into the slot in one of the poles, and carrying a foot-piece for bearing against the carbon supporting rod and pressing it against a roller contained by the slot in the core of one of the arms of the magnet, the opposite end of the armature being held by a spring away from the other pole of the magnet, but within the weaker portion of the magnetic field.

Electric Locomotive Engine; Leo Daft, Greenville, N. J..... 325,915

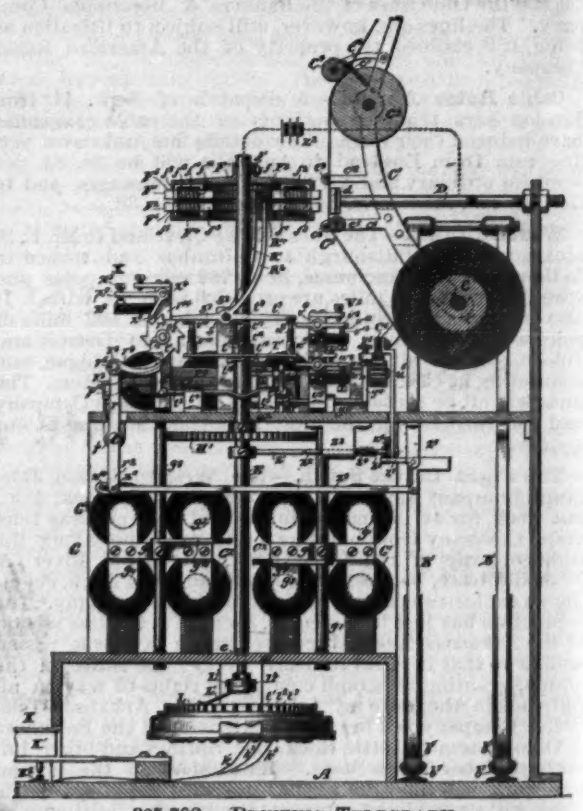
Consists of a field-magnet, two armatures driven thereby, driving-wheels supporting the engine, directly connected with the armatures, and adapted to receive the current from the track and circuit-connections, whereby the current from the track passes through the wheels and to and through the armature and field-magnets.

A Telephone Repeater; Moses G. Farmer, Newport, R. I..... 325,920

Consists of an electro-magnet having a polarized vibrating armature and connected with one circuit, in combination with pivoted strips or blades held in contact with a projection from the armature and connected with a second circuit.

Telephone Switch-Board Plug; Chester K. Mead, Des Moines, Iowa..... 325,953

Consists of a plug adapted to slide in the tubular handle, and provided with two flanges or projections to alternately engage the two distinct conductors on the handle, and



325,702. PRINTING TELEGRAPH.

a spring to press the plug outward relative to the tubular handle.

Laying Electric Wires; Walton D. Smith, Prophetstown, Ill., Assignor of three-quarters to Cyrus, Charles E. and Cora L. Emery, of same place..... 325,984

Consists first, in cutting the wires to proper lengths, insulating the wires except at the ends, and then connecting them together in a series; second, incasing the said series in a shell, and insulating them therein to complete the connection; third, placing this shell containing the wires in a section of pipe, the uncovered ends of the wires protruding beyond the sections; fourth, coupling the uncovered ends of the wires together; fifth, coupling the sections of the pipe together, and insulating the wires at each joint to form an unbroken connection, and, sixth, attaching the service-boxes and elbow-joints at the various points desired.

Copies of any of the Patents mentioned in this Record can be obtained, with full specifications and drawings, from this office on application; price twenty-five cents each.